Description

The FS1023 MEMS Liquid Flow Sensor Module measures the flow rate using the thermo-transfer (calorimetric) principle. The FS1023 is designed to measure liquids. The sensor output is amplified and trimmed at zero flow for module to module consistency.

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 and silicon-carbide coating, which protects it from abrasive wear and provides robustness and long-term reliability. In comparison, other sensors typically contain a fragile membrane above an etched cavity for the thermal isolation base.

There are no moving mechanical parts that can break in contrast to other flow meter types, such as a turbine-type meter. The FS1023 has minimal flow resistance, making it highly suitable for gravity-feed applications or for replacing a high-power pump with a lower power device.

The FS1023 is a NSF-certified component.

Typical Applications

- Beverage equipment
- Liquid-dispensing system
- Process controls and monitoring
- Fluid leak detection

Features

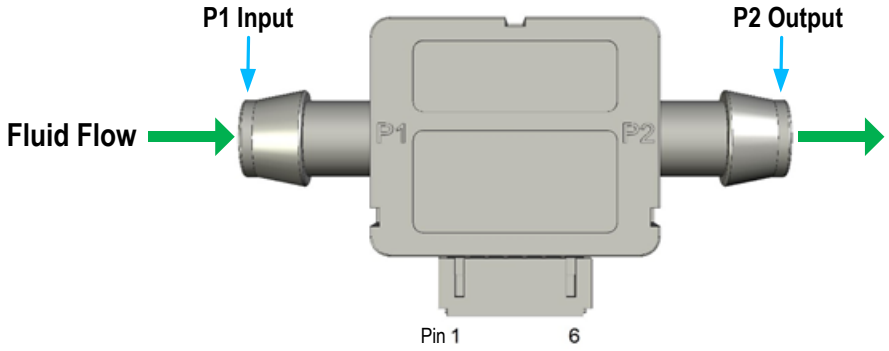
- Liquid flow: 0 to 3 liters/min
- Robust "solid" isolation technology
- Resistant to surface contamination
- No cavity to cause clogging
- Resistant to vibration and pressure shock
- Low-power application
- Minimal flow resistance
- Fast response: < 5ms
- Analog voltage output
- Thermistor voltage output: 1V to 4.5V
- Supply voltage: 5V
- Module operating temperature range: 0°C to +85°C

FS1023 Flow Sensor Module

NSF
COMPONENT

Pin Assignments

Figure 1. Pin Assignments for Module – Top View



Pin Descriptions

Table 1. Pin Descriptions

Pin Number	Pad Name	Type	Description
1	VDD	In	Supply voltage
2	GND	In	Ground
3	OUTPUT	Out	Flow analog output
4	NC	–	Do not connect[a]
5	HE	In	Heater enable, +5V
6	TEMP	Out	Thermistor analog output

[a] "NC" stands for not connected / no connection required / not bonded.

Absolute Maximum Ratings

The absolute maximum ratings are stress ratings only. Stresses greater than those listed below can cause permanent damage to the device. Functional operation of the FS1023 at absolute maximum ratings is not implied. Exposure to absolute maximum rating conditions might affect device reliability.

Table 2. Absolute Maximum Ratings

Symbol	Parameter	Conditions	Minimum	Maximum	Units
V_{IN}	Supply Voltage			5.5	V
T_{STOR}	Storage Temperature		0	105	°C

Operating Conditions

Table 3. Recommended Operating Conditions

Symbol	Parameter	Minimum	Typical	Maximum	Units
V_{IN}	Supply Voltage	5.0		5.5	V
T_{AMB}	Ambient Operating Temperature (in air)	0		85	°C
P_{CM}	Common-Mode Pressure			30	PSI

Electrical Characteristics

Table 4. Electrical Characteristics

Symbol	Parameter	Conditions	Minimum	Typical	Maximum	Units
I_{VIN}	Current Consumption			10	15	mA
F_{LQ}	Liquid Flow Range		0	3	3.5	Liter/min
V_{OUT}	Analog Voltage Output	At 0.5 Liter/min, 25°C (water)		1.66		V
		At 3.0 Liter/min, 25°C (water)		3.22		
V_{NULL}	Flow Null Voltage	In water, no flow	0	0.003	0.005	V
τ_H	Flow Response Time[a]			5		msec
V_{TEMP}	Temperature Output	At 5°C (in air)		4.25		V
		At 80°C (in air)		1.0		V

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

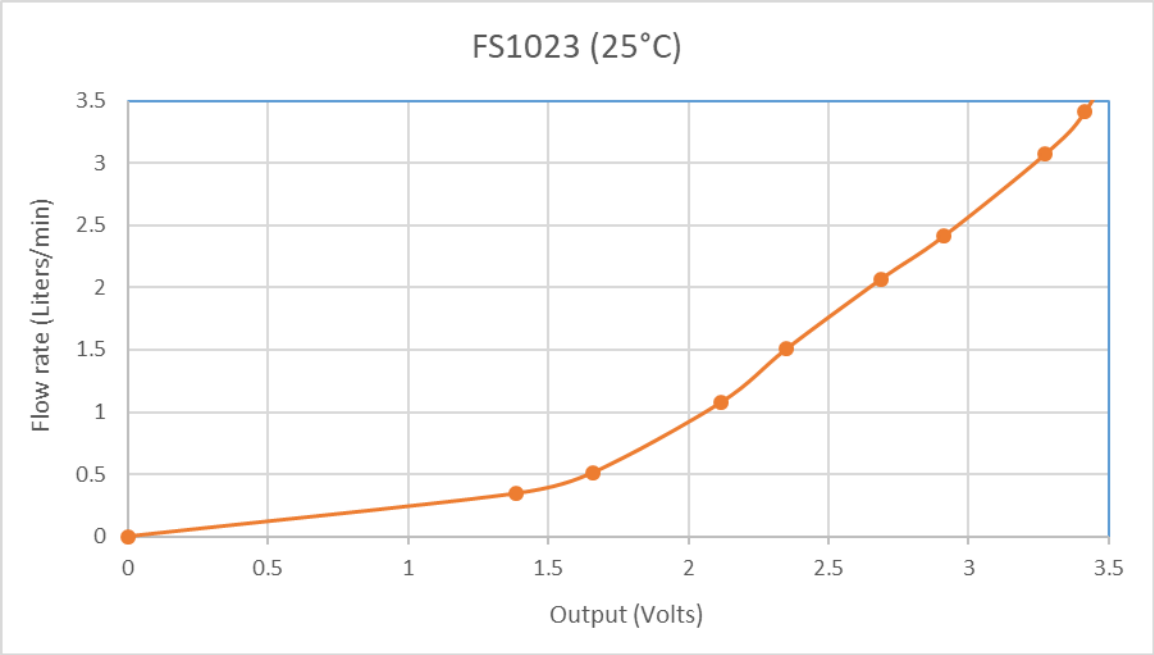
Flow Graphs

The graph in Figure 2 shows the voltage output versus flow.

From a flow rate of 0.5 to 3.0 SLPM, the voltage output can be correlated by the following approximation:

Flow rate (liters/min) = 0.2113 ∗ (V_{OUT})² + 0.5733 ∗ (V_{OUT}) – 1.0328

Figure 2. Flow Output Curve



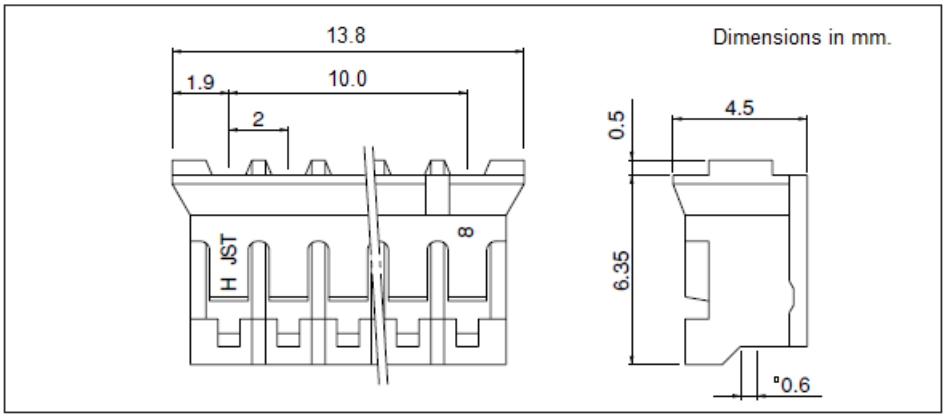
Heater Enable

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.

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 3. Receptacle Drawing



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

Tubing Guidance

The FS1023 module has barb tube endings. Tubing with a nominal 3/8inch (9.5mm) internal diameter is recommended for use. A hose clamp or zip tie can be used to secure the tubing.

Mechanical Drawings

The package outline drawings are appended at the end of this document and are accessible from the link below. The package information is the most current data available.

https://www.idt.com/document/psc/fs1023-package-outline-drawing-580-x-315-mm-module-mod0d1

Ordering Information

Orderable Part Number	Description and Package	Shipping Packaging	Temperature
FS1023	FS1023: 0 to 3 liter/min liquid flow sensor module with amplified analog output	Box	0°C to +85°C

Revision History

Revision Date	Description of Change
October 10, 2018	Updated specifications; added flow curve, electrical connector drawing, and module material.
December 18, 2017	Initial release.

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