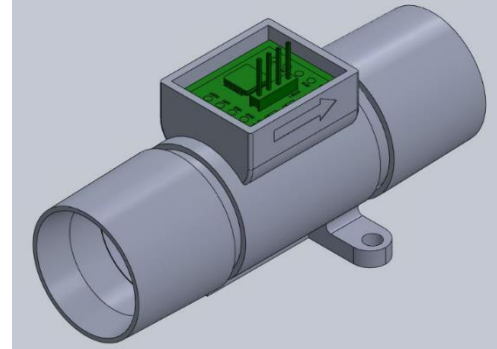


# MEMSIC Digital Gas Flow Sensor

## MFM2040U

### FEATURES

- Low Pressure Drop Flow Sensor
- High Accuracy +/-2.5% Reading
- Calibrated and Temperature Compensated for Air
- Low Power Consumption
- Digital I2C
- Made for Medical Applications
- Calibrated for Air, and O2



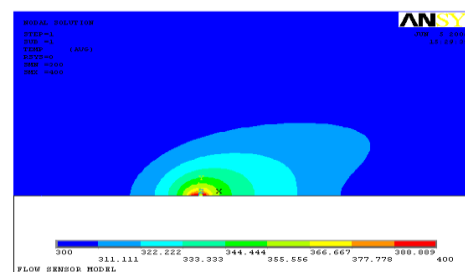
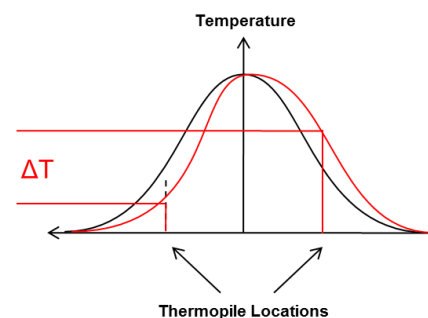
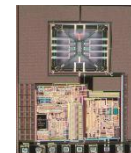
### DESCRIPTION

MEMSIC MFM2000 series is a gas flow sensor with low pressure drop capable of measuring medical gases up to 45 lpm. It is configured to be customizable with different flow inlet and outlet configurations.

### THEORY OF OPERATION

The flow rate is detected by the MEMS thermal mass flow sensor. The sensor chip, produced in MEMSIC proprietary CMOS compatible technology, is composed of a central heater source (micro heater) and two temperature sensors (thermopiles), which are placed symmetrically upstream and downstream of the micro-heater. If no gas flows over the sensor surface, the symmetric thermopiles measure the same rise in temperature, resulting in the same output voltage of the two thermopiles. If a non-zero gas flows from the inlet to the outlet of the meter, the velocity of a fully-developed laminar air flow unbalances the temperature profile around the heater and heat is transferred from upstream thermopiles to the downstream thermopiles, causing a change in the voltages of the thermopiles. Larger gas flow rates result in larger asymmetry in the profile.

Gas Flow →



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## FLOW PERFORMANCE

Measurements performed with air at 23 °C, 1 Atm, 50% RH, at 3.3V DC power supply, unless otherwise specified. Calibration conditions for standard liters per minute slm: 20 °C, 1013mbar.

Parameter	Condition	Min	Typical	Max	Unit
Flow Range	Calibration gas: Air	0.04		40	SLM
Calibrated Temperature Range		0		50	°C
Operating Temperature Range		-40	10	85	°C
Storage Temperature Range		-40		105	°C
Accuracy	25 °C +/-2 °C		+/-2.5		% Reading
Temperature Error	0-50 °C		+/-2.5		reading/ <sup>o</sup> C
Resolution	I2C		15		bit
Sampling Time			7.5		ms
Power Consumption	@ Recommended Heater Power at zero Flow			7.0	mA
	PD			650	uA
Pressure Drop	Max flow without mesh			60	Pa
	Max flow(with mesh screen) <sup>1</sup>			200	Pa
Operating Pressure Range	Absolute	0.7		1.3	Bar
Operating Overpressure	Absolute		+/-0.2		Bar
Averaging	10 frames running window averaging				
Wetted Materials	PES (Medical grade: biocompatible; ISO 10993 or USP Class VI), FR4, Silicon Nitrite, Silicon, Epoxy, Gold.				
Standards	RoHS, REACH, ISO15001, ISO10993-1, ISO10993-5,UL94 V0, IEC				

## ELECTRICAL SPECIFICATIONS (VDD=3.3V, TA=25C, UNLESS OTHERWISE NOTED)

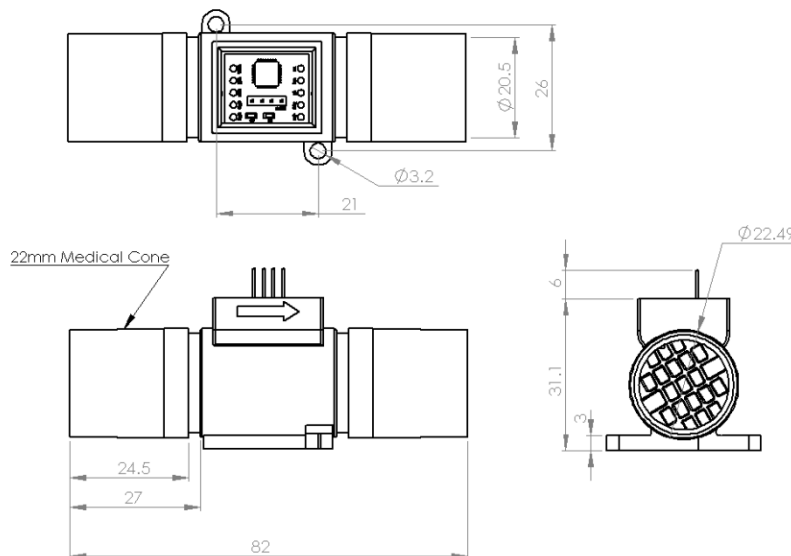
Parameter	Condition	Min	Typical	Max	Unit
Supply DC Voltage	DC	2.7	3.3	5.5	V
Power Consumption	@ Recommended Heater Power at zero Flow			7.0	mA
	PD			650	uA
Data format Scaling Factor	User read count value from register 0, then multiply by 1.25 to get actual flow rate in sccm.		1.25		sccm

<sup>1</sup> Mesh screens helps to reduce flow turbulence created by less than ideal inlet/outlet conditions such as sudden expansion, contractions and elbows.

### MECHANICAL SPECIFICATIONS

Specification	Condition	Min	Typical	Max	Unit
Burst Pressure	Over ambient	1			Bar

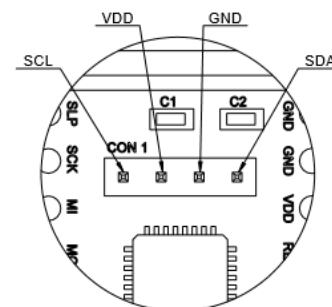
### DIMENSIONS: (UNIT:MM)



Note: Drawing not to scale

### CONNECTOR PIN DESCRIPTION

Pin	Name	Description
1	SCL	Series Clock Line
2	VDD	Digital power supply, reference voltage for SPI interface(2.7V-5.5V)
3	GND	Connect to ground
4	SDA	Series Data Line



### EXTERNAL INTERFACE

SCL and SDA line must be connected to VDD with about 4.7k Ohm pull-up resistor in series, the range of VDD is 2.7-5.5V, and calibration of the MFM2000 is performed at a voltage of 3.3V.

