LMM-H04 Mass Air Flow Sensor

- **Hot Film Anemometer Component**
- **Highly reliable and long term stable**
- **Uni-directional airflow measurement**
- **Fast reaction time**
- **Manufactured according ISO TS16949**
- **Can be adapted to various flow channel geometries**
- **Can be used for almost all kind of gases and volatile substances**

DESCRIPTION

LMM-H04 is a thermodynamic sensing element for the unidirectional measurement of mass air flow in a well defined channel. It is intended for applications with high reliability requirements such as automotive, medical or industrial gas flow applications. Mounted directly within the flowing media the LMM-H04 is sensitive against the heat transfer on a micrometer scale. This heat transfer is detected by a micro-machined silicon device which is mounted on ceramic substrate defining the geometry of the sensing element.

The functional principle of the LMM-H04 is a hot film anemometer, which is the thin film version of the hot wire anemometer. A thin film heating element (heater) is heated to a defined temperature difference with respect to the air. At zero flow there is heat dissipation due to the thermal conductivity of the air. With applied flow the heat dissipation increases steadily with the flow rate.

The sensing element can be operated at Constant Power and Constant Voltage mode. However, it is recommended to operate LMM-H04 in the described Constant Temperature Difference (CTD) mode. In the CTD mode the electronics detects any change of the thermal equilibrium very quickly and compensates it by adjusting the power settings through the heaters. This allows a very reliable mass flow measurement with a very short time constant which is in the order of milliseconds.

FEATURES

- Highly reliable and long term stability
- Fast reaction time
- Can be adapted to various flow channel geometries
- Can be used for almost all kinds of gases and volatile substances

APPLICATIONS

- Industrial gas flow measurement
- Leak detection in pressurized air systems
- Spirometers
- Air intake of combustion engines

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PERFORMANCE SPECS

Parameter	Min	Typ	Max	Condition
Max. Heater Overtemperature		100 K	< 120 K	approx. RH(Tamb)×1.5
Operating Temperature	-40 °C	+25 °C	+125°C	after bonding, with protected bond pads
Storage Temperature	-40 °C	+25 °C	+125°C	after bonding, with protected bond pads
Storage Temperature	+10 °C	+25 °C	+40°C	before bonding, 3 month

MECHANICAL DIMENSIONS AND CONNECTIONS

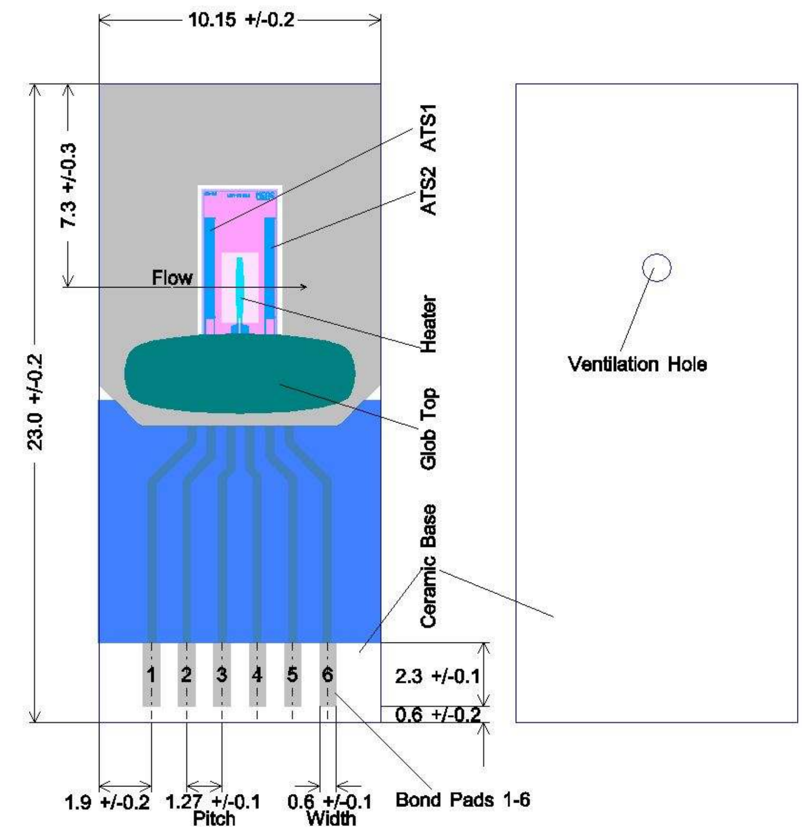

Figure 1: Mechanical dimensions and connections of LMM-H04

The sensor membrane has a thickness of about ~2 µm. Therefore it should not be exposed to any mechanical stress. One has to take care of a filter unit around the measurement device. High speed particles coming directly to the surface of the membrane can result in damages or shortage of the life time. The ventilation holes shall be kept open to release air pressure built up due to heating.

Parameter	Min	Typ	Max	Condition
Package Type		Hybride		25°C
Height Ceramics	0.48 mm	0.63 mm	0.78 mm	25°C
Height Ceramics + Metal	0.90 mm	1.10 mm	1.30 mm	25°C, at Glob Top position
max. overall Height			1.80 mm	25°C, including Glob Top
Bond Pad Material		AgPt		bondable with 150µm Al-wire

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ELECTRICAL PARAMETERS

Parameter	Min	Typ	Max	Condition
RATS1*	650 Ω	850 Ω	1050 Ω	Pad 1+2, 25°C
RHeater	40.0 Ω	45.0 Ω	50.0 Ω	Pad 3+4, 25°C
RATS2*	650 Ω	850 Ω	1050 Ω	Pad 5+6, 25°C
Temperatur Coefficients R_{ATS} and R_{Heater}	5500 ppm/K	6000 ppm/K	6500 ppm/K	0°C → 100°C
TCR Match			100 ppm/K	0°C → 100°C

*ATS = Ambient Temperature Sensor

APPLICATION EXAMPLE

One application of the LMM-H04 is to measure the amount of air coming into an engine. The actual mass air flow sensor module consists of a flow channel and a measurement channel, the so called Venturi channel. The measurement channel with the LMM-H04 should be placed in the center of the flow channel because at this place the flow is almost laminar and the flow velocity reaches its maximum. The cross sections of both channels can be adjusted to the amount of air which is supposed to be measured. For reproducible measurement results it is strictly required to avoid any turbulence at the surface of the sensing element.

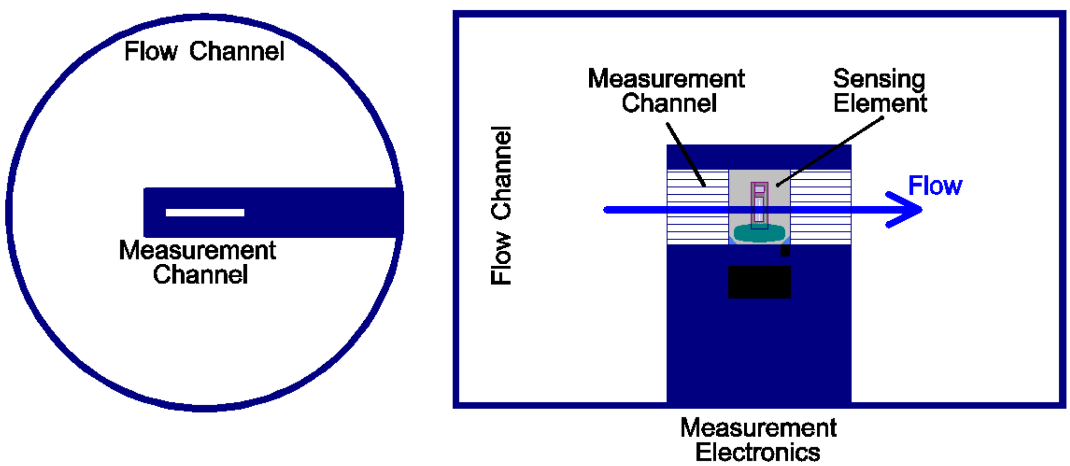
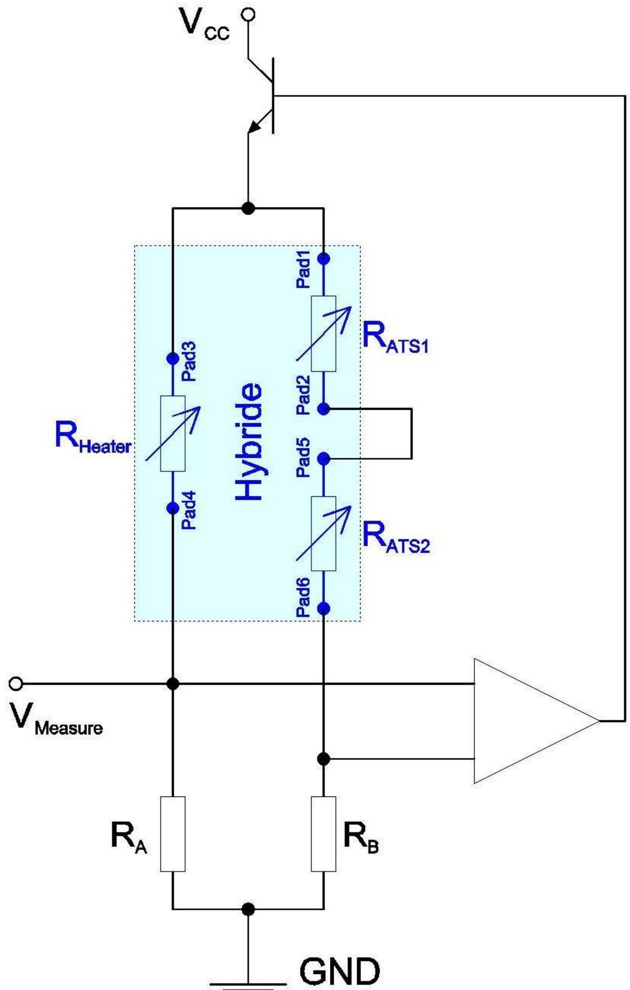


Figure 2: Flow channel of application example of a mass air flow sensor



Firgure 3: Outline of a measurement electronics using a Wheatstone-bridge.
NOTE: This drawing shows only the basic functionality. This is not a ready to use circuit diagram!

Above is shown an example of a measurement electronics using a Wheatstone-bridge. The resistors R_A and R_B need to be trimmed to operate the heater at a defined over-temperature

With a given electronics and measurement channel the measurement range can be easily adjusted by modifying the size of the flow channel. For higher or lower flow ranges the flow channel needs to be made larger or smaller, respectively.