CAPACITIVE HUMIDITY SENSOR

Ordering No. 15 65 08
KFS140-MSMD

Characteristic features

- **Temperature shock resistant**
- **Good Linearity**
- **Low Hysteresis**
- **Dew resistant**
- **Compact size**
- **Mechanically robust**
- **Optimum price performance ratio**
- **RoHS conform**

Typical areas of application

- **Automotive**
- **Household appliances (white goods)**
- **Consumer products**
- **Air conditioning**
- **Instrumentation**

Features

In the field of automotive technology, laundry dryers, house hold appliances and also in the area of industrial applications, always sensors are required which can provide precise measured value for the entire lifecycle of the product without the need for re-calibration.

Moreover, the price restrictions are so stiff for such high volume applications that only fully automatic mountable sensors stand a chance in the market.

The KFS140 SMD model fulfils this requirement especialybecause of its proven high performance polymer and the surface mountable SMD-model.

The sensor can certainly offer a better signal to noise ratio than monolithic integrated sensors and are also characterised by excellent long term stability in continuous operation under rough conditions.

Due to further miniaturisation, the sensors of the MSMD series are almost at the limit of technical feasibility in the range of SMD type humidity sensors. At present, it represents the smallest discrete humidity sensor world wide with an undoubted price performance ratio.

For further infomration, please visit our website:

www.hygrosens.com

Technical Data

Capacitive Humidity Sensor KFS140-MSMD	
Measuring principle	Capacitive Polymer humidity sensor
Humidity range	0 ... 100% r.H. (max. d.p. = 80 °C)
Temperature range	-50 ... +150 °C
Capacitance	180 pF ± 50 pF (at 23 °C) and 30% r.H.)
Gain value	0.3 pF / %r.H.
Tan δ	< 0.01
Hysteresis	< 1.5% r.H.
Response time	< 6 sec.
Frequence range	1 ... 100 kHz
max. evaluation voltage	< 12 Vpp ~
Signal waveform	AC voltage (without DC-component)
Dimensions	2.0 x 4.0 x 0.38 mm
Connection	SMD, for automatic equipment
Order No	KFS140-MSMD
Example circuits, Evaluation-Kits und complete Module available on request !	

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Packing

KFS140-SMD Tray of 448 pieces
KFS140-MSMD Tray of 400 pieces

The sensors in the tray are covered with an empty tray. Care should be taken that the sensors do not fall out while opening the trays. The sensors are laid out in the tray in such a manner that the active surface of the sensor faces downwards.

Storage

The sensors may be stored in the original tray itself. Storage temperature -20°C ... +50°C. The shelf life should not exceed 12 months.

Manual soldering

The sensor is not suitable for manual soldering, as the sensor gets overheated and damaged with high temperature.

PCB surface

Preferably, the PCB shall be coated with chemical gold plating or tin plating. The shelf life of PCB should be followed as per instructions of PCB manufacturer to ensure proper solderability.

In principle, HAL-tin plated PCBs are also suitable but care should be taken about the flat surface of the tinned pads!

Carrier substrate

For carrier substrate, standard materials like FR4 are suitable. The response behaviour of sensor is affected by the hygroscopic nature of substrate. This can be avoided by using special carrier substrate like ISOLA 640 or Roger RO 4003. It can be processed like FR-4 and has a very low water absorption property and high temperature withstanding capability.

Ceramics are also very well suitable for the purpose of carrier substrate, for example, as thick layer hybrid.

Landing Pattern

KFS140-MSMD **KFS140-SMD**

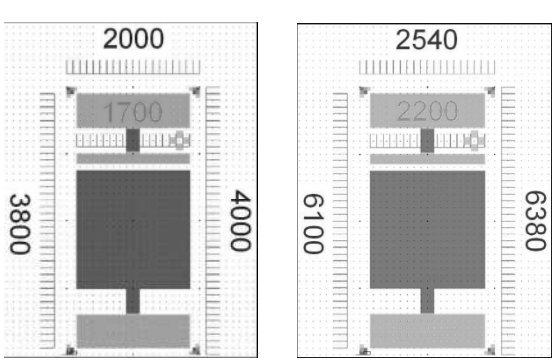

Illustration: Chip geometry of the SMD-Humidity sensors in µm

It should be ensured that the size and position of SMD soldering pads are matching with the outer rectangular part of the connection pad. The pads should not to be bigger and under no circumstances, they should go beyond the edge of the carrier ceramic.

SMD soldering process

The KFS140-SMD can be placed and soldered on the PCB together with other standard SMD components as per the usual reflow manufacturing process. The contact surfaces are of gold or palladium, which guarantees a good wetting behaviour.

The sensor is also suitable for vapour phase soldering, for which the compatibility of sensor must be checked for the applicable heat transfer medium. In case of vapour phase soldering, a boiling point temperature of 230°C is good enough for most lead free soldering pastes, in order to ensure proper melting. However, the data of paste manufacturers should be considered.

Temperature profile

The resulting soldering profile depends on the soldering paste used and concerned soldering plant.

The recommended profile should be obtained from the soldering paste manufacturer. The temperature profile provided by paste manufacturer is to be matched with other components used and the maximum allowable temperature of sensor.

The maximum allowed short time temperature for the sensor is around 250°C. The peak temperature of the soldering profile should be maximum 240 °C. Care should be taken that the maximum peak time of optimum 1 minute to a maximum 2 minutes is not exceeded.

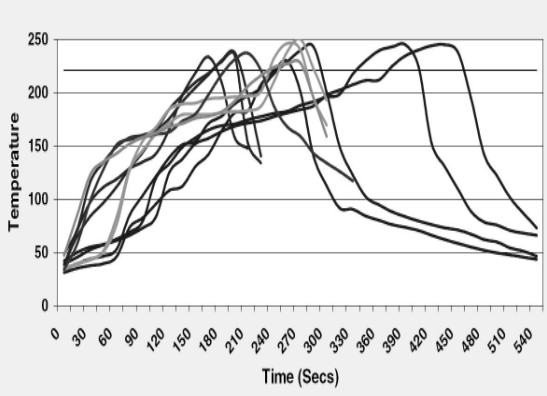

Illustration: Soldering profile recommended by the manufacturer Alpha-Metals for paste OMNIX OM 338. For KFS 140, the peak temperature must be below 240°C at approx. 1-minute peak hold time.

Soldering paste

The component is suitable for both lead based and lead free pastes.

If a lead free paste is to be used, then it should be noted that it has a high silver content and hence is likely to have a low melting point (generally 217° C).

The paste should have a low content of fluxing agent. The processing should be done as per manufacturer's guidelines. Paste in proper proportion (Dispenser) must be manually activated after the assembly (i.e. pre-dried), in order to evaporate the liquid components.

For example, one of the recommended soldering pastes is the NoClean Paste OMNIX OM 338 (alloy of Sn96.5 Ag3 Cu0.5), manufacturer Alpha Metals.

Contact through bonding

In principle, the metallising zones are also suitable for gold wired bonds. By bonded connection technique the humidity sensitive layer of the sensor can face upwards, which brings advantages with respect to the response behaviour. The sensor can be adhered on the backside to the carrier substrate with hot curing SMD adhesive. Please contact us if you need further information about this production technology.

Cleaning

The sensor may be blown off with oil free and filtered pure air (for drying or removing dust particles).

A cleaning of the populated circuit board is not necessary in general, but it is recommended according to application conditions (for example high humidity values). The sensor may be cleaned in Isopropanol at 23°C. Since the dirt materials accumulate in the cleaning agent, the bath should be regularly changed. It should be repeatedly cleaned many times, either in Isopropyl alcohol or pure water with max. 15 µS conductance. Subsequently, the circuit board is blown with cleaned compressed air and dried in oven at 60°C for 24 hours.

The application of ultrasound is possible, but however, it is not recommended.

Calibration

The calibration may be done after the process steps - soldering, cleaning and drying. Between the cleaning process (followed by drying) and calibration, there should always be a time gap of at least 48 hours during which the populated circuit board should be stored under normal room conditions so that the residual water content in carrier substrate can come into an equilibrium state.

ESD protection

Like most components, the capacitive humidity sensor KFS 140 should be protected from electrostatic discharges, since the thin polymer layer can permanently get damaged.

Mechanical damage

The active sensor surface should not be damaged, touched or contaminated.

The SMD sensor can be placed from the rear side of the component with usual Pick & Place tools. Alternatively, the sensor can also be held at the outer edge. The sensitive layer side may not be touched! Through contact with sharp-edged tools on the layer side, the polymer insulation can get pierced and the sensor can permanently get damaged!

During soldering, special care should be taken to ensure that the fluxing agent or solder does not reach the active surface.

The sensor should not be subjected to mechanically rough conditions, for example bending or touching with sharp edged objects.

Patent rights caution

We would like to inform you as a precaution, that we take no liability for any patent infringements, which result from use of protected third party printed circuit board designs and board layouts.

Specially, the use of edge sealant for hygroscopic circuit board materials in the vicinity of humidity sensors is a third party patented item.

Moreover, there is also a third party patent with respect to improvement of heat conduction between sensor surface and a nearby temperature sensor.

The infringement of such and similar layout patents is to be avoided by suitable design technical measures, for example, by use of suitable circuit board materials or good air circulation in the sensor area. Also the sensor area should be isolated from rest of the circuit board with the help of special housing design with respect to humidity or thermal behaviour.

Individual problem solutions

If you have questions regarding the production processes, you may please discuss with our research/development department, contact person, Mr Friedrich. We would like to share with you, our experiences from other projects. We will be able to certainly to help you further regarding your questions or production technology problems.

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