

# DATASHEET

## SMARTEC CAPACITIVE HUMIDITY SENSOR HS07/08A

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The capacitive humidity sensor of Smartec is based on silicon technology on glass wafer. Due to the use of this process it is possible to make sensors on a high volume scale on a low cost way. This humidity sensor consists of three layers. The base and top layer are conductive and the layer in between is humidity sensitive polyimide. The selection of this sensitive interface makes the sensor highly independent to temperature effects. The top layer has grid like structure. The sensor converts the humidity into a capacitance. Due to the construction the response to humidity is very fast (<15 sec) and the hysteresis very low (<2% RH)

### Typical applications

- Hygrometers, consumer goods
- Humidifiers and Dehumidifiers
- Medical applications
- Weather stations
- Automotive
- HVAC
- Food processing
- Room comfort control



### Product highlights

- Measures from 0 to 100 % RH. In many applications condensation on the sensor may occur. This has no effect on the performance of the sensor but the response time while drying will be long.
- Linearity within a band of 2% in the range between 20 and 95% RH.
- Fast response time (response time < 15 s.)

### Specifications

measured @ 25 °C, sensor excitation: 1V @ 20 kHz

Parameter	Condition	HS07			HS08A			Unit
		Min	Typ	Max	Min	Typ	Max	
Capacitance	55% RH	310	330	350	170	180	190	pF
Sensitivity	20 - 95 % RH		0,6			0,34		pF/%RH
Hysteresis	20 -95 % RH			2			2	% RH
Linearity	20 - 95 % RH			±2			±2	%RH
Response time	30 - 90 % RH			15		15		sec
Temp coefficient	5 - 70 °C	0,15	0,16	0,17			0,07	pF/°C
Long term stability				0,2			0,5	%RH/year
Temperature range		-40		120	-40		120	°C
Operating humidity range		0		100	0		100	% RH
Frequency range		1		100	1		100	kHz

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## Understanding the specifications

The measuring of humidity is difficult. Generally the humidity in air is measured as the fraction of the maximum amount of water that air can absorb at a certain temperature. At atmospheric conditions and a given temperature this fraction can vary between 0 (absolute dry) and 100% (the point where condensation will begin to form). This relative humidity is only valid at a certain temperature and atmospheric pressure. Therefore it is important that a humidity sensor should not be affected by either temperature or pressure. Many sensing techniques, such as mechanical devices and resistive type sensors are temperature dependent. Even the wet and dry bulb is pressure dependent.

The HS07 humidity sensors can be used in a wide range of applications, like low cost commercial applications as well as in medical and industrial products.

## About the relation between capacitance and the relative humidity

The relation between the measured capacitance and the Relative Humidity (RH) is depicted below:

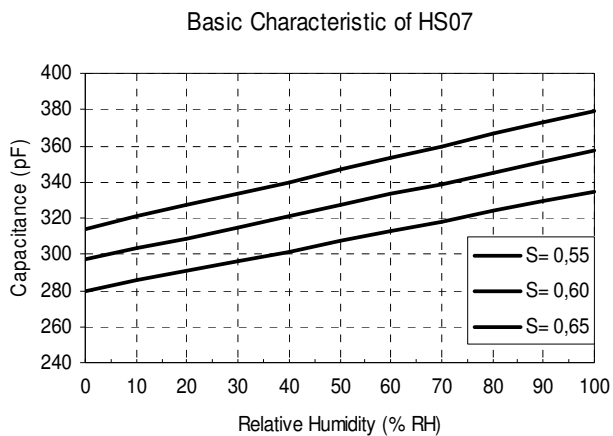
$$C_c = C_s + S * (X_{rh} - 55)$$

With:  $C_c$  = measured capacitance(pF)  
 $C_s$  = capacitance value at 55% RH (pF)  
 $X_{rh}$  = measured Relative Humidity(%)  
 $S$  = sensitivity

This means the Relative Humidity can be calculated by:

$$X_{rh} = (C_c - C_s) / S + 55$$

Due to the tolerance of  $C_s$  it is needed to perform a calibration. In the graph below the response of the sensor is given.



The measurement range is between 10% RH and 95% RH



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## Calibration

Due to the high linearity of the humidity sensor it is only needed to calibrate on one point.

In one of the Smartec's application notes (on <http://notes.smartec-sensors.com/>) salt solutions for calibration can be found. A poor man's solution is to place the humidity sensor into a refrigerator. Inside a refrigerator the humidity is always 100%.

The factory tests have been done at 55% relative humidity. Depending on the application of the humidity sensor calibration can be done at higher humidity level as well on lower humidity level. The long term stability (0.2 %/yr) guarantees a stable working for years.

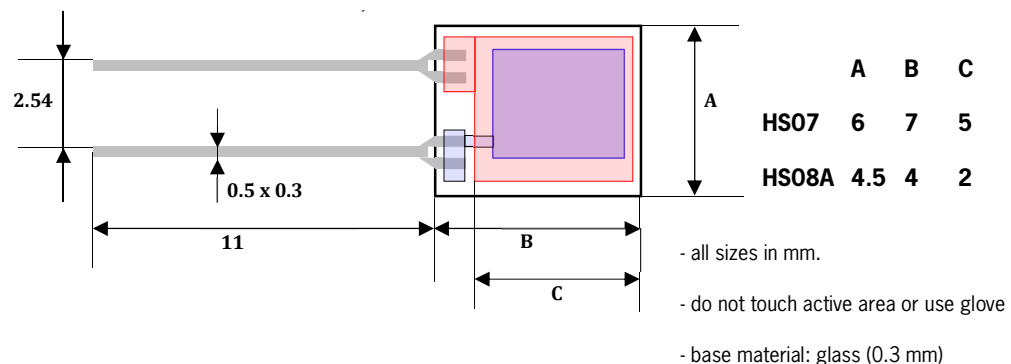
## Tolerance

The specified tolerance is the tolerance of the capacitor at 60% RH. This tolerance can be considered as an effect of the production technology. When the capacitor is f.i. 2 % too high (@ 0% RH) also the sensitivity will be around 2% too high.

## Linearity

The linearity is considered as the maximum deviation from a straight line between 0% RH and 100% RH. In the condensing area some drift can be expected; but this drift is reversible. The device is resistant against submerge in water.

## Mechanical outline



## Ordering code:

**SMTHS07** Humidity sensor 330 pF @ 55% RH

**SMTHS08A** Humidity sensor 180 pF @ 55% RH

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