

## Installation Instructions for the HCH-1000 Series Capacitive Humidity Sensors ISSUE 1 50018326

### GENERAL INFORMATION

The HCH-1000 Series is a capacitive polymer sensor designed for relative humidity measurement. The sensor converts humidity value into capacitance, which can be measured electronically.

Polyimide is used as a humidity sensing material because of its inherent IC (Integrated Circuit) processing compatibility, reduced temperature dependence and enhanced resistance against contamination. The HCH-1000-Series is manufactured using semiconductor technology.

### STANDARD CHARACTERISTICS

The sensor consists of a grid top electrode, a polyimide layer, and a bottom electrode. The grid top electrode on the bottom electrode provide enhanced sensitivity compared to that of a standard structure. Figure 1 shows the typical response curve in a humidity range of 0% RH to 100% RH.

### SENSOR OPERATING RANGE

Although the HCH-1000 Series may not fail beyond the limits, as shown in Figure 2, the specification only applies to operation within the working range.

FIGURE 2: OPERATING RANGE

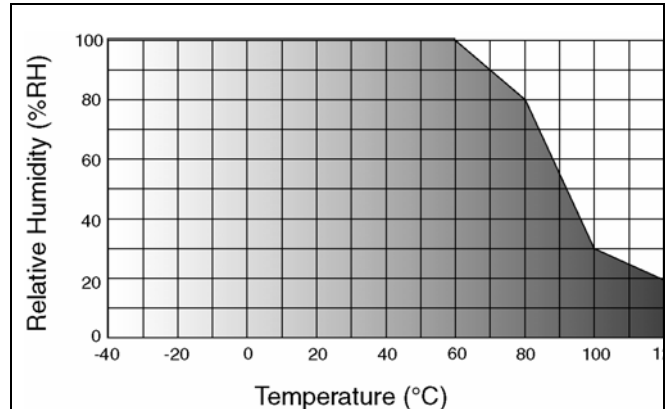
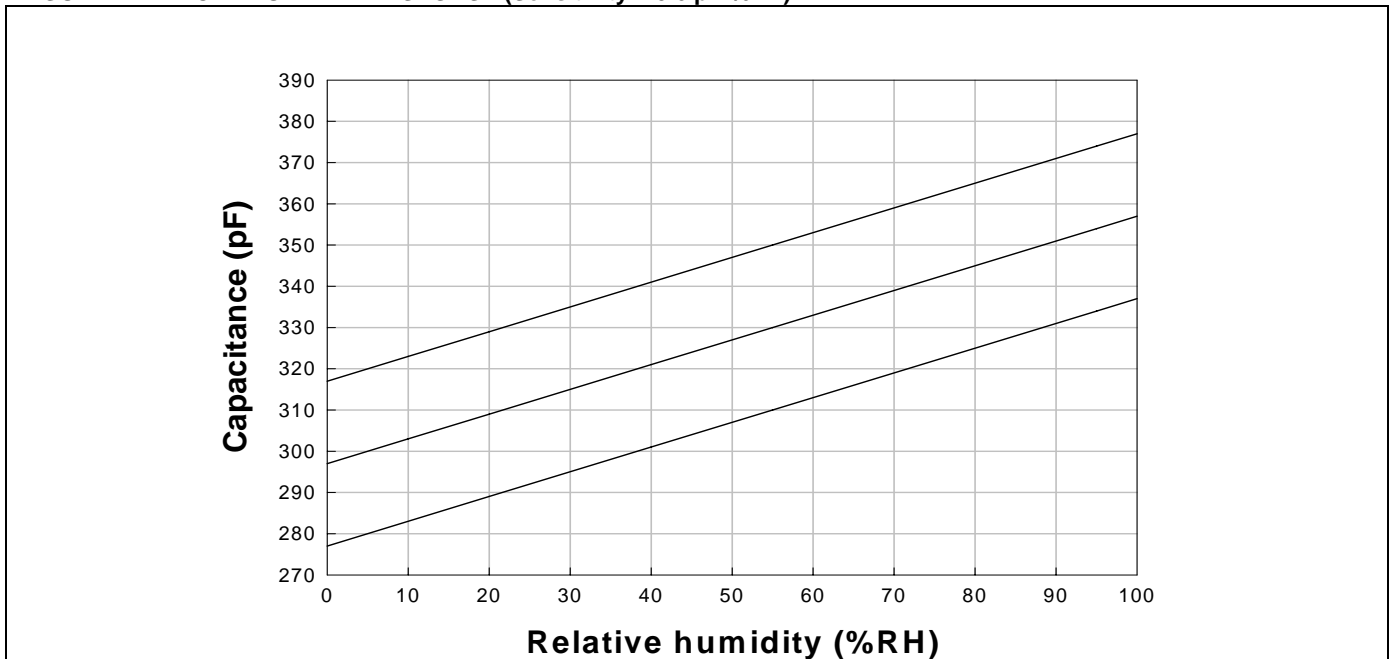


FIGURE 1: TYPICAL HUMIDITY RESPONSE (Sensitivity = 0.6 pF %RH)



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## SPECIFICATIONS (T<sub>A</sub> = 25 °C [77 °F], Input Voltage = 1 V<sub>RMS</sub>, Frequency = 20 kHz)

Characteristic	Min.	Typ.	Max.	Unit	Note
Normal capacitance	310	330	350	pF	at 55% RH
Sensitivity	0.55	0.6	0.65	pF/% RH	10% RH to 95% RH
Humidity hysteresis	–	±2	–	% RH	–
Linearity	–	±2	–	% RH	–
Response time	–	15	–	sec	30% RH to 90% RH
Temperature coefficient	0.15	0.16	0.17	pF/°C	5 °C to 70 °C [41 °F to 158 °F]
Long-term stability (drift)	–	0.2	–	% RH/year	–
Operating temperature range	-40 [-40]	–	120 [248]	°C [°F]	–
Operating humidity range	0%	–	100%	RH	–
Operating frequency range	1	–	100	kHz	–

### BASIC CAPACITANCE CHARACTERISTICS

Capacitance is measured by applying 1 V<sub>rms</sub> at 20 kHz at 25 °C. The sensor characteristic is determined by the following formula:

$$C_C(\%RH) = C_S \text{ at } 55\%RH + S \times [(\%RH(C_M) - \%RH(C_S))]pF$$

Where,

S	Sensitivity (pF/%RH)
C <sub>C</sub> (%RH)	Calculated capacitance at the measured relative humidity
C <sub>S</sub> at 55 %RH	Standard capacitance value at 55% RH
%RH(C <sub>M</sub> )	Measured relative humidity value
%RH(C <sub>S</sub> )	Standard relative humidity value (55% RH)

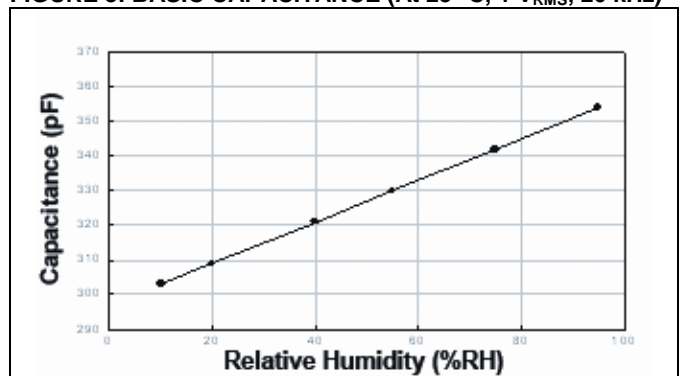
Figure 3 shows the typical characteristic curve. The average increase in capacitance value within the working range of 10% RH to 95% RH is typically 56 pF.

$$\%RH(C_C) = \frac{C_M(\%RH) - C_S \text{ @ } 55 \%RH}{S} + \%RH(C_S)$$

Where,

S	Sensitivity (pF/%RH)
C <sub>M</sub> (%RH)	Measured capacitance value
C <sub>S</sub> at 55%RH	Standard capacitance value at 55% RH
%RH(C <sub>C</sub> )	Calculated relative humidity value at the measured capacitance
%RH(C <sub>S</sub> )	Standard relative humidity value (55% RH)

FIGURE 3: BASIC CAPACITANCE (At 25 °C, 1 V<sub>RMS</sub>, 20 kHz)



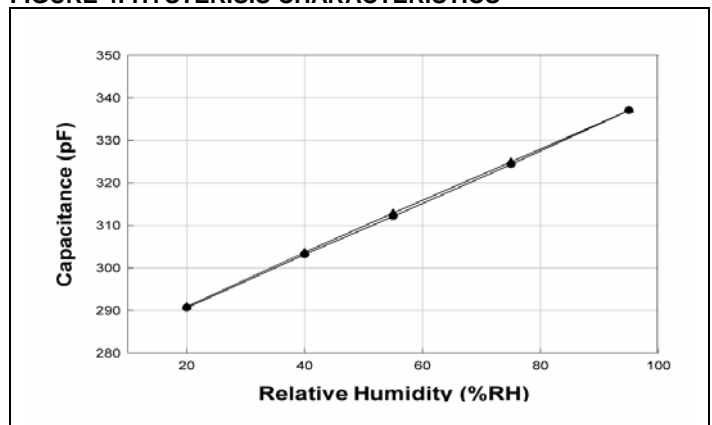
### HYSTERESIS CHARACTERISTICS

Figure 4 shows the hysteresis curve. The hysteresis formula is:

$$\text{Hysteresis Value} = C(20\%RH \Rightarrow 95\%RH) - C(95\%RH \Rightarrow 20\%RH)$$

The hysteresis value is measured under 1 pF. The hysteresis of measured samples indicates between ±3% RH at each humidity point.

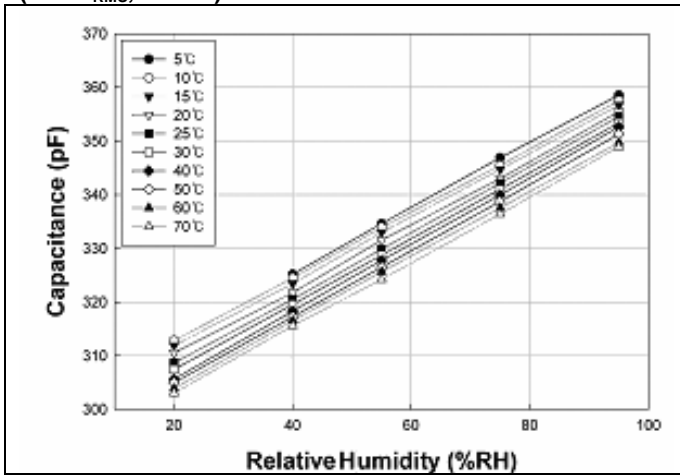
FIGURE 4: HYSTERESIS CHARACTERISTICS



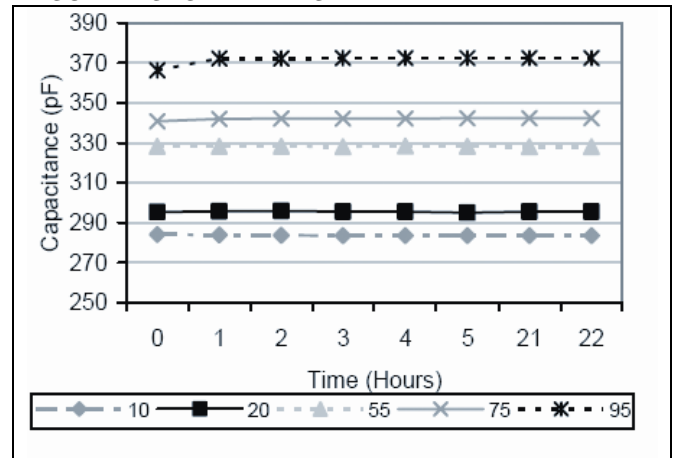
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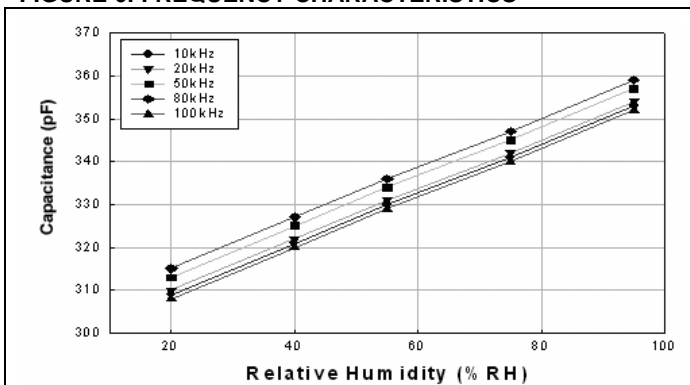
**FIGURE 5: TEMPERATURE CHARACTERISTICS**  
(At 1 V<sub>RMS</sub>, 20 kHz)



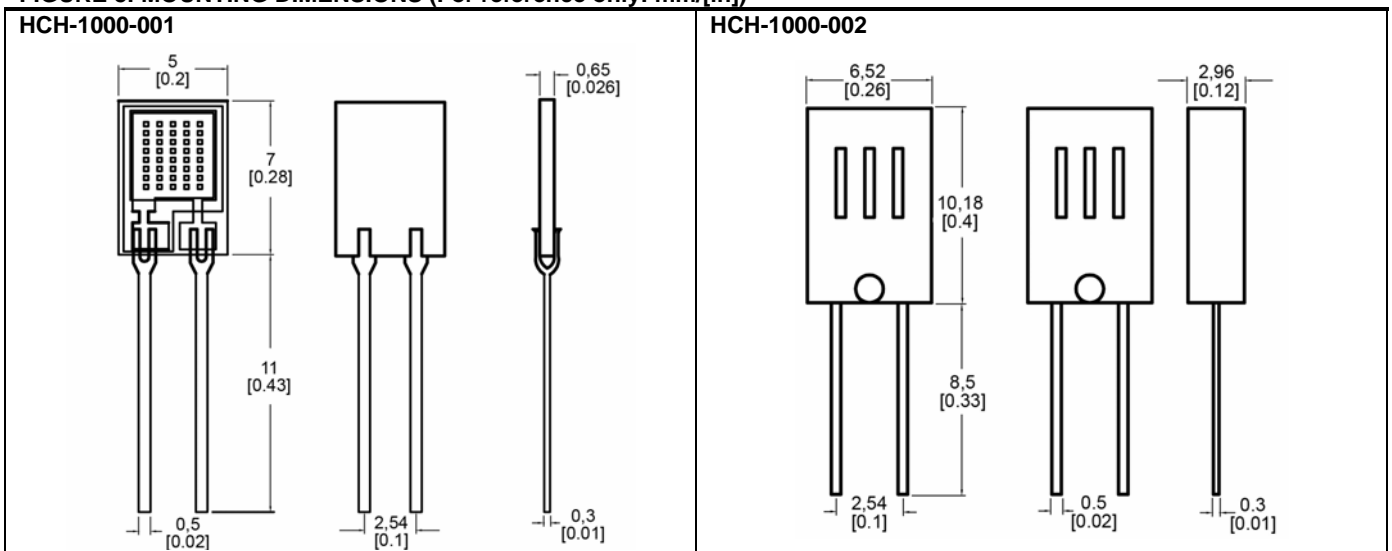
**FIGURE 7: SHORT-TERM STABILITY**



**FIGURE 6: FREQUENCY CHARACTERISTICS**



**FIGURE 8: MOUNTING DIMENSIONS (For reference only: mm/[in])**



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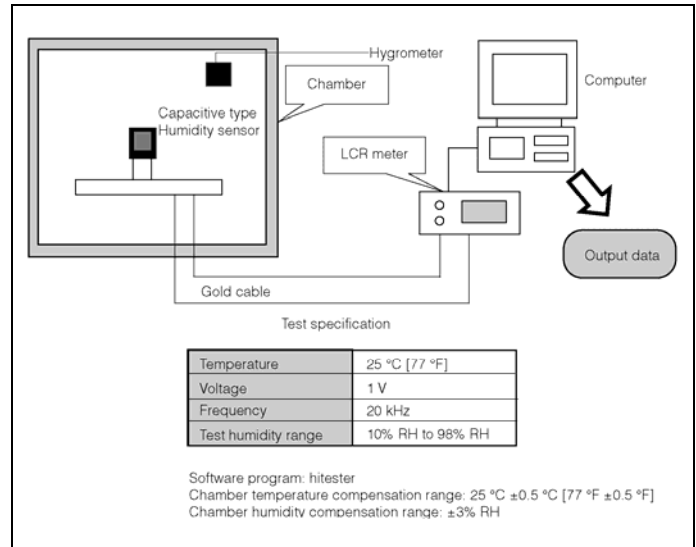
## ENVIRONMENTAL TEST SYSTEM

Figure 9 depicts environmental testing. The devices are characterized at 25 °C [77 °F] between 20% RH and 95% RH. The meter is set to measure capacitance at 1 V and 20 kHz.

For precise measurement, a hygrometer is compared with the humidity of the temperature-humidity chamber.

The data output indicates the effect of sensor characterization before/after the environmental tests.

FIGURE 9: ENVIRONMENTAL TEST SYSTEM DIAGRAM



## WARNING

### PERSONAL INJURY

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

**Failure to comply with these instructions could result in death or serious injury.**

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