

# HC105/HC109

## SMD Humidity Sensors for Mass Applications

### Typical Applications

automotive - air conditioning  
home appliances  
photocopy machines

### Features

SMD mounting  
high reproducibility  
wetable  
very good long term stability  
small size construction

### Technical Data

Sensor		HC105	HC109
Nominal capacitance $C_0$ (at 30°C / 86°F)		160 ± 16 pF	80 ± 12 pF
	$C_{76}$ (at 30°C / 86°F)	201.6 ± 20.3 pF	100.8 ± 15.1 pF
Response time $t_{90}$		< 6 sec.	< 6 sec.
Sensitivity		0.55 pF /% RH	0.27 pF /% RH
Temperature dependence		$dC = -0.0019 \cdot RH \cdot (T-30^\circ C)$ [pF]	$dC = -0.0019 \cdot RH \cdot (T-30^\circ C)$ [pF]
Working range	humidity	0...100% RH	0...100% RH
	temperature	-40...120°C (-40...248°F)	-40...120°C (-40...248°F)
Linearity error	(0...98% RH)	< ± 1.5% RH	< ± 1.5% RH
Hysteresis		1.7 ± 0.15% RH	1.7 ± 0.15% RH
Long term stability at 20-30°C (68-86°F) / 20-80%RH		drift < 1.5 % / year	drift < 1.5 % / year
Loss tangent		< 0.05 typical	< 0.05 typical
Maximum supply voltage (no DC voltage)		5V max (Upp)	5V max (Upp)
Maximum DC voltage		< 5mV	< 5mV
Operating frequency		10...100 kHz, recommended 20kHz	10...100 kHz, recommended 20kHz
	Packaging	tray 101.6x101.6 mm (4x4") tape and reel	420 sensors refer to ordering guide

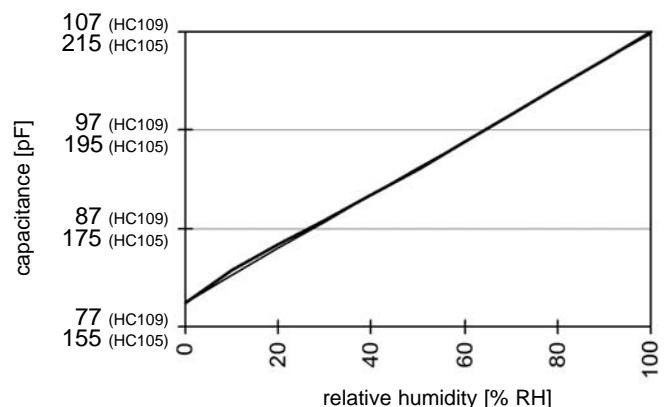
### Characteristics

The average increase of capacitance over the working range is 55pF (HC105) resp. 27.5pF (HC109). For the range of 0–98% RH linear approximation is possible, errors will be lower than < ± 1.5% RH.

The sensor characteristic is determined by the following linear formula:

$$C(RH) = C_0 \cdot [1 + HC_0 \cdot RH]$$

with  $HC_0 = 3420 \pm 191$  ppm /% RH



For high accuracy requirements, the sensitivity is determined by the following polynomial:

$$C(RH) = C_0 \cdot [1 + HC_0 \cdot RH + K(RH)]$$

whereby:

$$K(RH) = A_1 \cdot RH + A_2 \cdot RH^{1.5} + A_3 \cdot RH^2 + A_4 \cdot RH^{2.5}$$

$$A_1 = 2.6657E^{-3} \quad A_2 = -9.6134E^{-4}$$

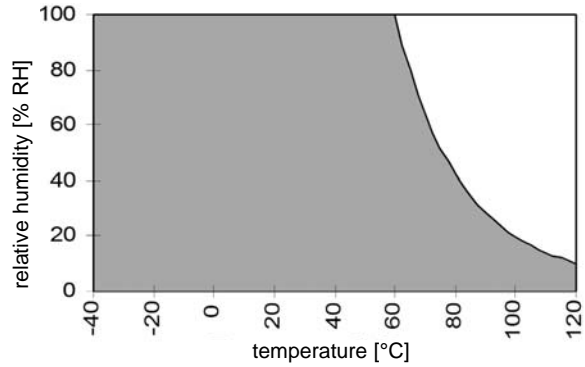
$$A_3 = 1.1272E^{-4} \quad A_4 = -4.3E^{-6}$$

## Working Range

The working range of the humidity sensors HC105/HC109 is shown with regard to the humidity / temperature limits.

Although the sensors would not fail beyond the limits, the specification is guaranteed only within the working range.

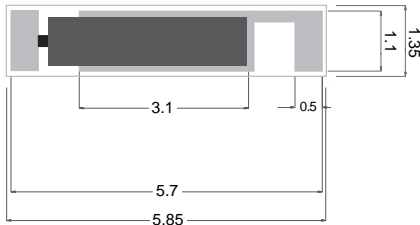
In applications with high humidity at high temperatures the time factor shall be considered.



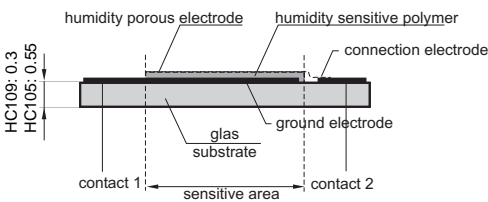
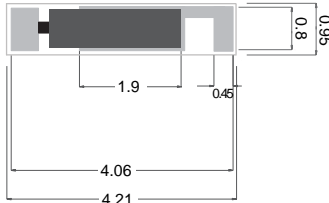
## Dimensions (mm)

1 mm = 0.03937" / 1" = 25.4 mm

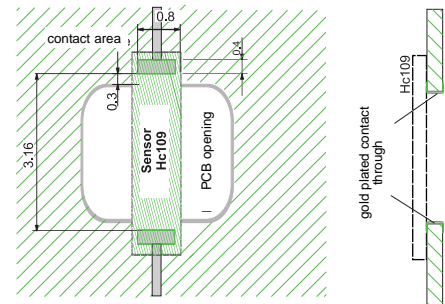
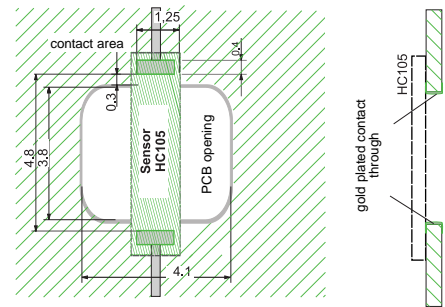
### HC105



### HC109



## Mounting Instructions



To allow full access of the air, the humidity sensor should be positioned over an opening in the printed circuit board (PCB).

False readings because of humidity assimilation at the front side of the PCB should be avoided as much as possible by using gold-plated-through holes.

## Assembling and Soldering

HC105/HC109 sensor series are designed for SMD automatic assembling with subsequent reflow-soldering.

### Recommended SMD equipment:

- Automatic tooling machine with suction pipette
- Optical control for sensor identification

## Ordering Guide

TYPE	PACKAGING
capacitive humidity sensor 160 pF (105)	tray (for HC105 only) (no code)
capacitive humidity sensor 80 pF (109)	500 sensors per reel (TR0,5)
	1000 sensors per reel (TR1)
	2500 sensors per reel (TR2,5)
	10000 sensors per reel (TR10)
<b>HC</b>	

## Order Example

### HC105TR1

SMD humidity sensor

Type: HC105

Packaging: 1000 sensors per reel

# HC104-Kxx

xx...humidity calibration point

## Interchangeable SMD Humidity Sensors for Mass Applications

### Typical Applications

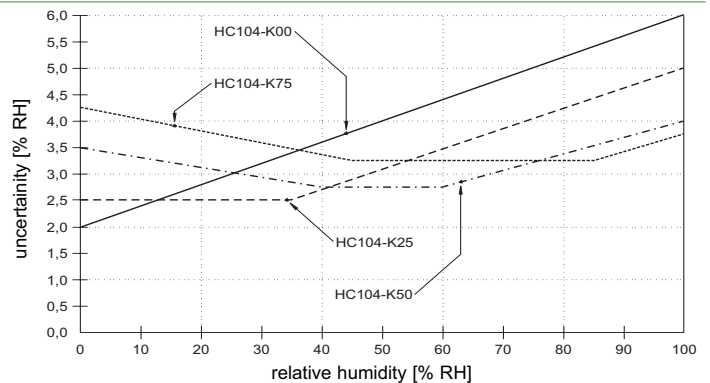
mass appliances  
 photocopy machines  
 automotive - air conditioning

### Features

interchangeable  
 inexpensive, easy humidity calibration  
 best accuracy without calibration  
 SMD compatible  
 outstanding long term stability  
 wettable

### Technical Data

Sensor	HC104-K00	HC104-K25	HC104-K50	HC104-K75
Calibration point	0% RH	25% RH	50% RH	75% RH
Nominal capacity at calibration point [pF]	140	152.5	163.8	175.9
Interchangeability				



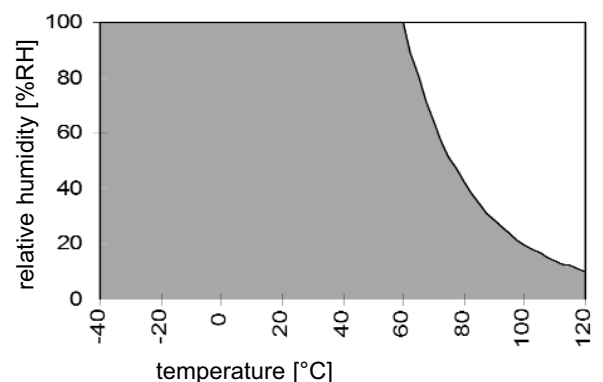
Sensitivity	0.48 pF / % RH
Temperature dependence	$dC = -0.00166 \cdot RH \cdot (T - 30^\circ C)$ [pF]
Working range humidity	0...100% RH
temperature	-40...120°C (-40...248°F)
Linearity error (0 ... 98% RH)	< ± 1.5% RH
Hysteresis	1.7 ± 0.15% RH
Response time $t_{90}$	< 6 s
Long term stability at 20-30°C (68-86°F) / 20-80% RH	drift < 1.5 % / year
Loss tangent	< 0.05 typical
Maximum supply voltage (no DC voltage)	5 V max (Upp)
Maximum DC voltage	< 5 mV
Operating frequency	10...100 kHz, recommended 20kHz
Packaging tray 101.6x101.6 mm (4x4")	240 sensors
tape and reel	refer to ordering guide

### Working Range

The working range of the humidity sensors HC104-Kxx is shown with regard to the humidity / temperature limits.

Although the sensors would not fail beyond the limits, the specification is guaranteed only within the working range.

In applications with high humidity at high temperatures the time factor shall be considered.



## Characteristics

The average increase of capacitance over the working range is 55pF. For the range of 0–98% RH linear approximation is possible, errors will be lower than ± 1.5% RH.

The sensor characteristic is determined by the following linear formula:

$$C(RH) = C_0 * [1 + HC_0 * RH]$$

with  $HC_0 = 3420 \pm 191 \text{ ppm / \% RH}$

For high accuracy requirements, the sensitivity is determined by the following polynomial:

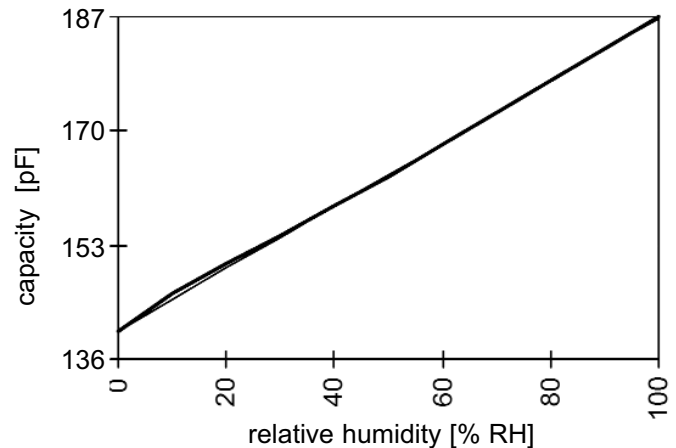
$$C(RH) = C_0 * [1 + FK_0 * r.F. + K(RH)]$$

whereby:

$$K(RH) = A_1 * RH + A_2 * RH^{1.5} + A_3 * RH^2 + A_4 * RH^{2.5}$$

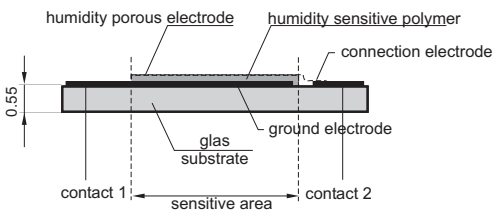
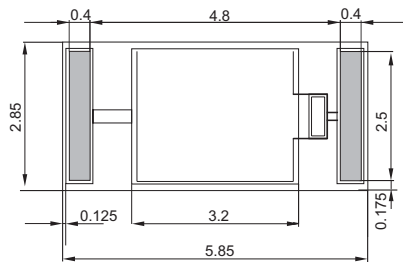
$$A_1 = 2,6657E^{-3} \quad A_2 = -9,6134E^{-4}$$

$$A_3 = 1,1272E^{-4} \quad A_4 = -4,3E^{-6}$$



## Dimensions (mm)

1 mm = 0.03937" / 1" = 25.4 mm



## Mounting Instructions

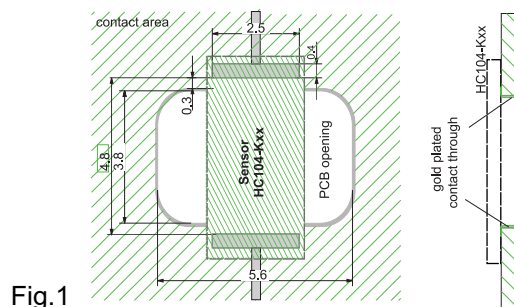


Fig.1

To allow full access of the air, the humidity sensor should be positioned over an opening in the printed circuit board (PCB). - Fig.1

False readings because of humidity assimilation at the front side of the PCB should be avoided as much as possible by using gold-plated-through holes.

## Ordering Guide

TYPE		PACKAGING	
Interchangeable capacitive humidity sensor 140 pF, calibration point 0% RH	(104-K00)	tray (240 sensors)	(no code)
Interchangeable capacitive humidity sensor 152.5 pF, calibration point 25% RH	(104-K25)	500 sensors per reel	(TR0,5)
Interchangeable capacitive humidity sensor 163.8 pF, calibration point 50% RH	(104-K50)	1000 sensors per reel	(TR1)
Interchangeable capacitive humidity sensor 175.9 pF, calibration point 75% RH	(104-K75)	2500 sensors per reel	(TR2,5)
		10000 sensors per reel	(TR10)
<b>HC</b>			

## Order Example

**HC104-K50TR2,5**  
 SMD Humidity Sensor

Type: HC104-K50  
 Packaging: 2500 sensors per reel

## HC104-Kxx

# HC201

## Humidity Sensors for HVAC Applications

### Typical Applications

HVAC  
hand helds  
humidifiers  
dehumidifiers

### Features

high repeatability  
high sensitivity  
wetable  
very good long term stability  
good resistance to pollutants  
small size construction

### Technical Data

Nominal capacitance $C_{76}$ (at 20°C / 68°F)	200 ± 30 pF	
Sensitivity	0.6 pF / % RH	
Working range	Humidity	10...95% RH
	Temperature	-40...110°C (-40...230°F)
Linearity error (20...90% RH)	< ± 2% RH	
Hysteresis	2.0 ± 0.3% RH	
Response time $t_{90}$	< 15 sec	
Temperature dependence [%RH / °C]	$\Delta RH = g * RH * (T - 20)$	$g = -0.004 \pm 10 \%$
Long term stability at 20-30°C (68-86°F) / 20-80% RH	drift < 1.5 % / year	
Loss tangent	< 0.1 typical	
Maximum supply voltage (no DC voltage)	5 V max (Upp)	
Maximum DC voltage	< 5 mV	
Operating frequency	10...100 kHz, recommended 20 kHz	
Material connection	phosphor bronze with tin coating	

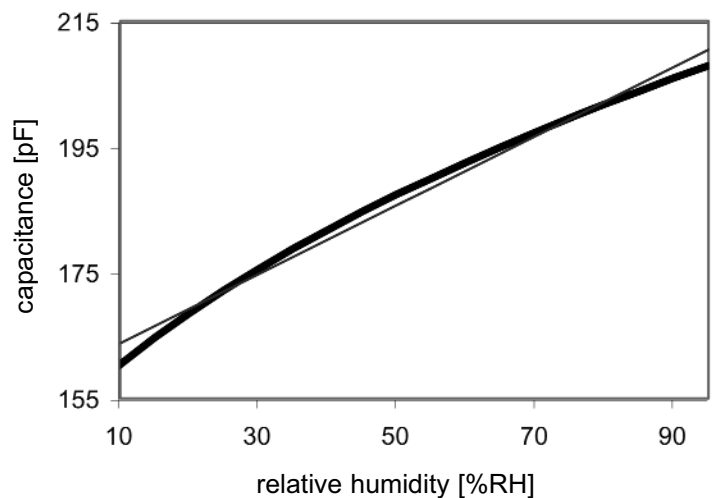
### Characteristics

The average increase of capacitance over the working range is 50pF. For the range of 20–90% RH, linear approximation is possible, errors will be lower than ± 2% RH.

The sensor characteristic is described by the following linear formula:

$$C(RH) = C_{76} * [1 + HK * (RH - 76)]$$

with  $HK = 2700 \pm 250 \text{ ppm / \% RH}$

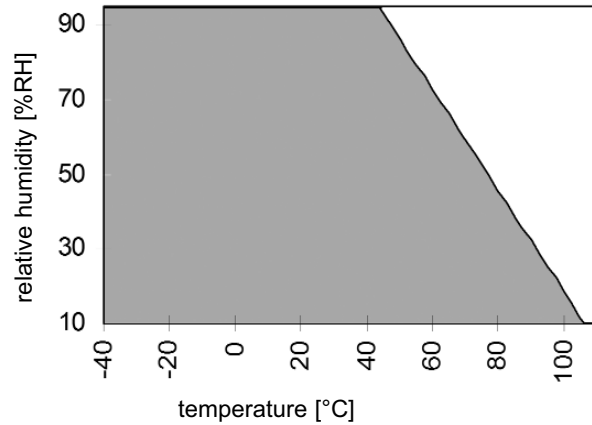


## Working Range

The working range for the humidity sensor HC201 is shown with regard to the humidity / temperature limits.

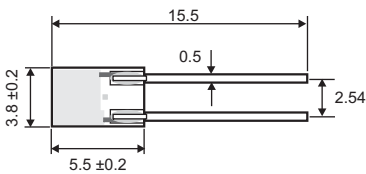
Although the sensors would not fail beyond the limits, the specification is guaranteed only within the working range.

In applications with high humidity at high temperature the time factor shall be considered.

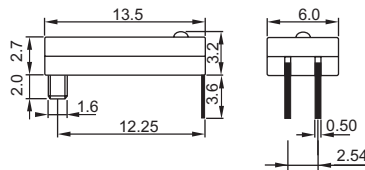


## Dimensions (mm)

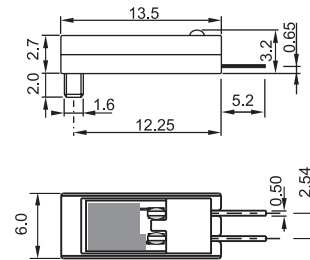
1 mm = 0.03937" / 1" = 25.4 mm



**HC201**



**HC201/H**



**HC201/G**

## Ordering Guide

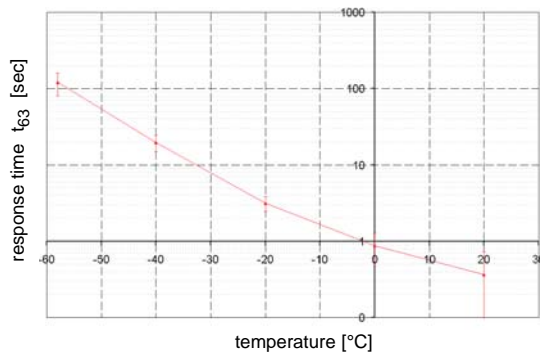
MODEL	TYPE
HC	capacitive humidity sensor 200 pF (201)
	capacitive humidity sensor 200 pF with PC housing for mounting on the printed circuit board (201/H)
	capacitive humidity sensor 200 pF with PC housing (201/G)
HC	

# HC103M2

## Fast High End Humidity Sensors for Radiosondes / Registering Balloons

### Technical Data

Nominal capacitance $C_0$ (at 30°C / 86°F)	160 ± 40 pF
Sensitivity	0.55pF /% RH
Working range humidity	0...100% RH
temperature	-80...120°C (-112...248°F)
Linearity error (0...98% RH)	< ± 2% RH
Hysteresis	1.9 ± 0.25% RH
Response time RH $t_{63}$	



Temperature dependence <sup>1)</sup>	$dC = -0.0019 \cdot RH \cdot (T - 30^\circ C)$ [pF]
Loss tangent	< 0.05
Maximum supply voltage	5V max (UPP)
Maximum DC voltage	< 5mV
Operating frequency	10...100 kHz, recommended 20kHz
Packaging tray 101.6x101.6 mm (4x4")	240 sensors
tape and reel	refer to ordering guide

1) more details for  $t < -20^\circ C$  on request

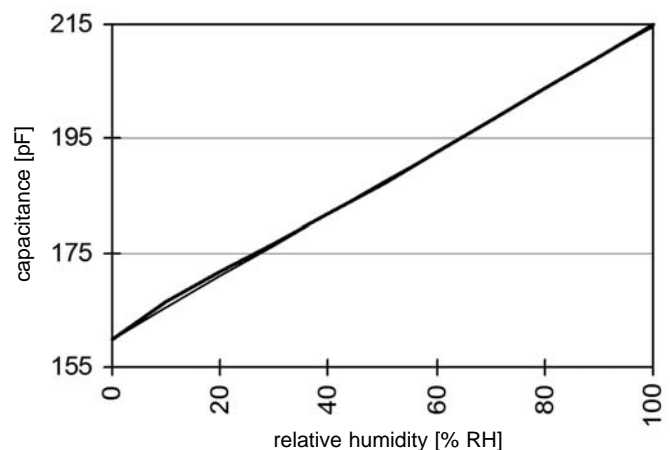
### Characteristics

The average increase of capacitance over the working range is 55pF. For the range of 0–98% RH linear approximation is possible, errors will be lower than < ± 2% RH.

The sensor characteristic is determined by the following linear formula:

$$C(RH) = C_0 \cdot [1 + HC_0 \cdot RH]$$

with  $HC_0 = 3420 \pm 250$  ppm /% RH



For high accuracy requirements, the sensitivity is determined by the following polynomial:

$$C(RH) = C_0 \cdot [1 + HC_0 \cdot RH + K(RH)]$$

whereby:

$$K(RH) = A_1 \cdot RH + A_2 \cdot RH^{1.5} + A_3 \cdot RH^2 + A_4 \cdot RH^{2.5}$$

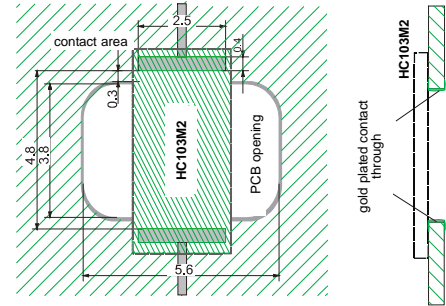
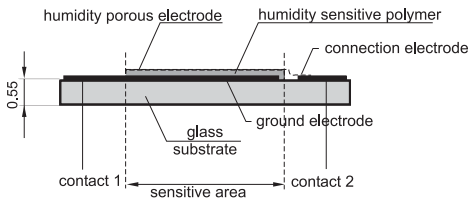
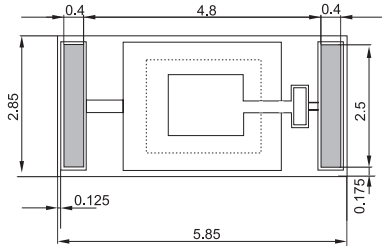
$$A_1 = 2.6657E^{-3} \quad A_2 = -9.6134E^{-4}$$

$$A_3 = 1.1272E^{-4} \quad A_4 = -4.3E^{-6}$$

Dimensions (mm)

1 mm = 0.03937" / 1" = 25.4 mm

Mounting Instructions



To allow full access of the air, the humidity sensor should be positioned over an opening in the printed circuit board (PCB).

False readings because of humidity assimilation at the front side of the PCB should be avoided as much as possible by using gold-plated-through holes.

Assembling and Soldering

HC103M2 sensor series are designed for SMD automatic assembling with subsequent reflow-soldering. For more details please refer to mounting instructions.

**Recommended SMD equipment:**

- Automatic tooling machine with suction pipette
- Optical control for sensor identification

Ordering Guide

Order Example

TYPE	PACKAGING
HC103M2	(103M2) tray (240 sensors) (no code)
	500 sensors per reel (TR0,5)
	1000 sensors per reel (TR1)
	2500 sensors per reel (TR2,5)
	10000 sensors per reel (TR10)
HC	

**HC103M2TR1**

Type: HC103M2  
 Packaging: 1000 sensors per reel