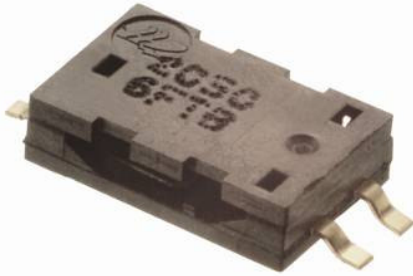




HTS2030SMD – Temperature and Relative Humidity Sensor



- Miniature Surface mount SMD package
- Lead free component
- Patented solid polymer structure
- Suitable for linear voltage or frequency output circuitry
- Fast response time and very low temperature coefficient

DESCRIPTION

Based on a unique **capacitive cell for humidity** measurement and a **Negative Temperature Coefficient (NTC)** thermistor for temperature measurement, this dual-purpose relative humidity / temperature miniaturized sensor is designed for high volume, **cost sensitive applications with tight space constraints**. It is useful in all applications where **dew point, absolute humidity measurements** or humidity compensation are required.

FEATURES

- Full interchangeability with no calibration required in standard conditions
- Instantaneous desaturation after long periods in saturation phase
- Compatible with automatized assembly processes, including Pb free wave soldering and reflow processes ⁽¹⁾
- Individual marking for compliance to stringent traceability requirements
- Part may be washed with distilled water

(1) Soldering temperature profiles available on request / contact us at humidity.application@meas-spec.com

APPLICATIONS

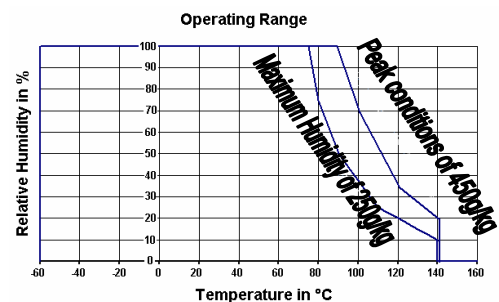
- Automotive
- Home Appliance
- Printers
- Meteorology

PERFORMANCE SPECS

MAXIMUM RATINGS

| Ratings | Symbol | Value | Unit |
|--------------------------|--------|------------|------|
| Operating Temperature | Ta | -60 to 140 | °C |
| Storage Temperature | Tstg | -60 to 140 | °C |
| Supply Voltage (Peak) | Vs | 10 | Vac |
| Humidity Operating Range | RH | 0 to 100 | % RH |

Peak conditions: less than 10% of the operating time.





HTS2030SMD – Temperature and Relative Humidity Sensor

ELECTRICAL CHARACTERISTICS

(Ta=25°C, measurement frequency @10kHz unless otherwise noted)

| Humidity Characteristics | Symbol | Min | Typ | Max | Unit |
|--|-----------------|-----|--------|------|--------|
| Humidity Measuring Range | RH | 1 | | 99 | %RH |
| Supply Voltage | Vs | | | 10 | V |
| Nominal Capacitance @55%RH ⁽¹⁾ | C | 177 | 180 | 183 | pF |
| Temperature coefficient | T _{cc} | | | 0.01 | pF/°C |
| Average Sensitivity from 33% to 75%RH | ΔC/%RH | | 0.31 | | pF/%RH |
| Leakage Current (Vcc=5V) | I | | | 1 | nA |
| Recovery time after 150 hours of condensation | tr | | 10 | | s |
| Humidity Hysteresis | | | | +/-1 | %RH |
| Long Term Stability | T | | +/-0.5 | | %RH/yr |
| Time Constant (at 63% of signal, still air) 33%RH to 80%RH | τ | | 3 | 5 | s |
| Deviation to typical response curve (10% RH to 90%RH) | | | +/-2 | | %RH |

(1) Tighter specification available on request

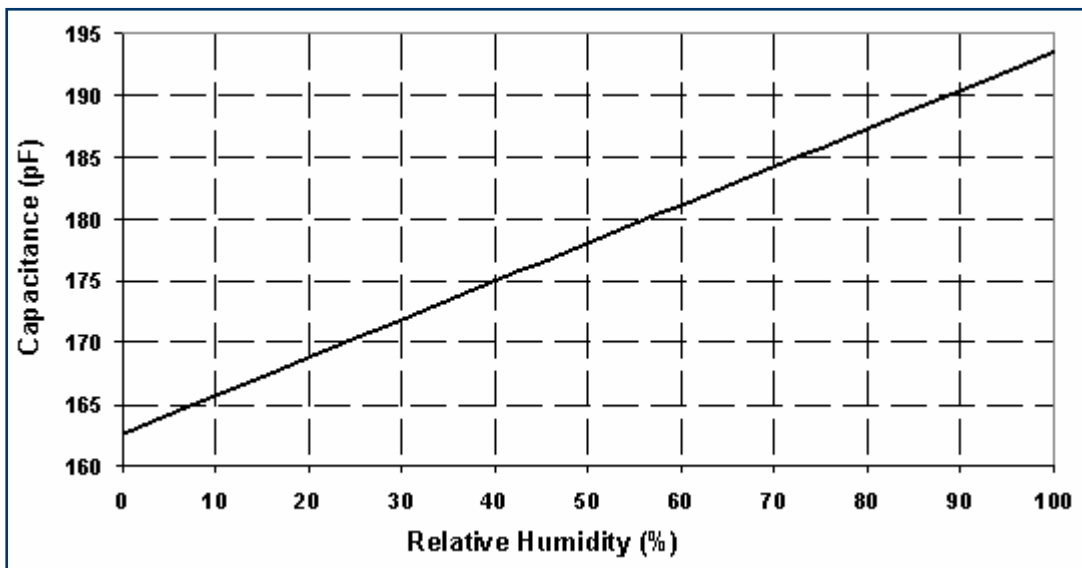
| Temperature Characteristics | Symbol | Min | Typ | Max | Unit |
|------------------------------------|----------------|------|------|------|------|
| Nominal Resistance @25°C | R | | 10 | | kΩ |
| Beta value: B25/100 | β | 3600 | 3730 | 3800 | |
| Temperature Measuring Range | Ta | -60 | | 140 | °C |
| Nominal Resistance Tolerance @25°C | R _N | | 2 | 3 | % |
| Beta Value Tolerance | β | | 3 | | % |
| Response Time | τ | | 10 | | s |

TYPICAL PERFORMANCE CURVES

HUMIDITY SENSOR

- Polynomial Response

$$C \text{ (pF)} = C@55\% * (3.903 \cdot 10^{-8} * RH^3 - 8.294 \cdot 10^{-6} * RH^2 + 2.188 \cdot 10^{-3} * RH + 0.898)$$



HTS2030SMD – Temperature and Relative Humidity Sensor

- Typical Response Look-Up Table (polynomial reference curve) @10kHz/1V

| RH (%) | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Cp (pF) | 161.6 | 163.6 | 165.4 | 167.2 | 169.0 | 170.7 | 172.3 | 173.9 | 175.5 | 177.0 | 178.5 |
| RH (%) | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | |
| Cp (pF) | 180 | 181.4 | 182.9 | 184.3 | 185.7 | 187.2 | 188.6 | 190.1 | 191.6 | 193.1 | |

- Reverse Polynomial Response

$$RH (\%) = -3.4656 \cdot 10^{+3} \cdot X^3 + 1.0732 \cdot 10^{+4} \cdot X^2 - 1.0457 \cdot 10^{+4} \cdot X + 3.2459 \cdot 10^{+3}$$

With $X = C(\text{read}) / C@55\%RH$

TEMPERATURE SENSOR

- Typical Temperature Output

Depending on the needed temperature measurement range and associated accuracy, we suggest two methods to access to the NTC resistance values.

$$R_T = R_N \times e^{\beta \left(\frac{1}{T} - \frac{1}{T_N} \right)}$$

| | |
|----------|--|
| R_T | NTC resistance in Ω at temperature T in K |
| R_N | NTC resistance in Ω at rated temperature T in K |
| T, T_N | Temperature in K |
| β | Beta value, material specific constant of NTC |
| e | Base of natural logarithm (e=2.71828) |

① The exponential relation only roughly describes the actual characteristic of an NTC thermistor can, however, as the material parameter β in reality also depend on temperature. So this approach is suitable for describing a restricted range around the rated temperature or resistance with sufficient accuracy.

② For practical applications, a more precise description of the real R/T curve may be required. Either more complicated approaches (e.g. the Steinhart-Hart equation) are used or the resistance/temperature relation as given in tabulation form. The below table has been experimentally determined with utmost accuracy for temperature increments of 1 degree.

Actual values may also be influenced by inherent self-heating properties of NTCs. Please refer to MEAS-France/Humirel Application Note HPC106 “Low power NTC measurement”.

HTS2030SMD – Temperature and Relative Humidity Sensor

• Temperature look-up table

| Temp (°C) | Resistance (Ω) | Max Deviation (Ω) |
|-----------|----------------|-------------------|
| -40 | 262960 | 35403 |
| -39 | 247217 | 32777 |
| -38 | 232539 | 30358 |
| -37 | 218845 | 28130 |
| -36 | 206064 | 26075 |
| -35 | 194110 | 24178 |
| -34 | 182852 | 22416 |
| -33 | 172332 | 20791 |
| -32 | 162498 | 19290 |
| -31 | 153299 | 17905 |
| -30 | 144790 | 16636 |
| -29 | 136664 | 15444 |
| -28 | 129054 | 14343 |
| -27 | 121925 | 13325 |
| -26 | 115243 | 12383 |
| -25 | 109030 | 11516 |
| -24 | 103115 | 10705 |
| -23 | 97565 | 9953 |
| -22 | 92354 | 9257 |
| -21 | 87460 | 8612 |
| -20 | 82923 | 8020 |
| -19 | 78581 | 7463 |
| -18 | 74497 | 6947 |
| -17 | 70655 | 6468 |
| -16 | 67039 | 6023 |
| -15 | 63591 | 5606 |
| -14 | 60381 | 5222 |
| -13 | 57356 | 4865 |
| -12 | 54503 | 4533 |
| -11 | 51813 | 4225 |
| -10 | 49204 | 3932 |
| -9 | 46767 | 3662 |
| -8 | 44467 | 3411 |
| -7 | 42296 | 3177 |
| -6 | 40247 | 2960 |
| -5 | 38279 | 2756 |
| -4 | 36455 | 2568 |
| -3 | 34731 | 2393 |
| -2 | 33100 | 2230 |
| -1 | 31557 | 2078 |

| Temp (°C) | Resistance (Ω) | Max Deviation (Ω) |
|-----------|----------------|-------------------|
| 0 | 30029 | 1932 |
| 1 | 28627 | 1799 |
| 2 | 27299 | 1675 |
| 3 | 26042 | 1560 |
| 4 | 24852 | 1452 |
| 5 | 23773 | 1355 |
| 6 | 22708 | 1261 |
| 7 | 21698 | 1174 |
| 8 | 20739 | 1093 |
| 9 | 19829 | 1017 |
| 10 | 18959 | 946 |
| 11 | 18128 | 879 |
| 12 | 17338 | 817 |
| 13 | 16588 | 759 |
| 14 | 15876 | 705 |
| 15 | 15207 | 654 |
| 16 | 14569 | 607 |
| 17 | 13962 | 563 |
| 18 | 13384 | 522 |
| 19 | 12834 | 484 |
| 20 | 12280 | 447 |
| 21 | 11777 | 413 |
| 22 | 11297 | 382 |
| 23 | 10840 | 353 |
| 24 | 10404 | 325 |
| 25 | 10000 | 300 |
| 26 | 9600 | 300 |
| 27 | 9218 | 300 |
| 28 | 8853 | 299 |
| 29 | 8506 | 297 |
| 30 | 8178 | 296 |
| 31 | 7866 | 294 |
| 32 | 7568 | 292 |
| 33 | 7283 | 290 |
| 34 | 7011 | 287 |
| 35 | 6734 | 284 |
| 36 | 6484 | 281 |
| 37 | 6244 | 278 |
| 38 | 6015 | 275 |
| 39 | 5796 | 271 |

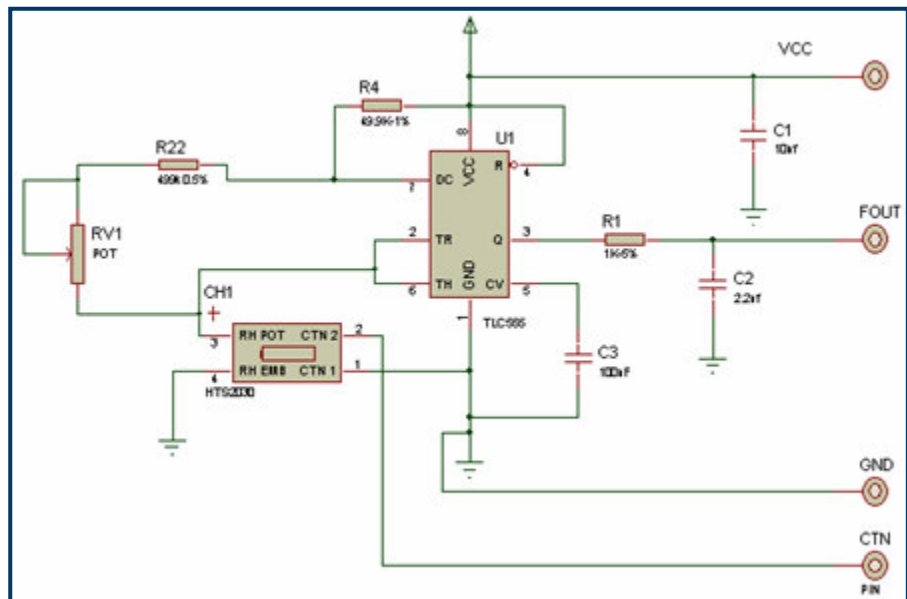
| Temp (°C) | Resistance (Ω) | Max Deviation (Ω) |
|-----------|----------------|-------------------|
| 40 | 5575 | 267 |
| 41 | 5373 | 264 |
| 42 | 5180 | 260 |
| 43 | 4995 | 257 |
| 44 | 4817 | 253 |
| 45 | 4636 | 248 |
| 46 | 4473 | 245 |
| 47 | 4316 | 241 |
| 48 | 4166 | 237 |
| 49 | 4021 | 233 |
| 50 | 3874 | 229 |
| 51 | 3737 | 225 |
| 52 | 3606 | 221 |
| 53 | 3481 | 217 |
| 54 | 3360 | 213 |
| 55 | 3237 | 208 |
| 56 | 3126 | 204 |
| 57 | 3019 | 200 |
| 58 | 2917 | 197 |
| 59 | 2819 | 193 |
| 60 | 2720 | 189 |
| 61 | 2629 | 185 |
| 62 | 2542 | 182 |
| 63 | 2458 | 178 |
| 64 | 2378 | 175 |
| 65 | 2304 | 171 |
| 66 | 2229 | 168 |
| 67 | 2158 | 165 |
| 68 | 2089 | 161 |
| 69 | 2022 | 158 |
| 70 | 1960 | 155 |
| 71 | 1898 | 152 |
| 72 | 1839 | 149 |
| 73 | 1782 | 146 |
| 74 | 1727 | 143 |
| 75 | 1673 | 140 |
| 76 | 1622 | 138 |
| 77 | 1573 | 135 |
| 78 | 1526 | 132 |
| 79 | 1480 | 130 |

| Temp (°C) | Resistance (Ω) | Max Deviation (Ω) |
|-----------|----------------|-------------------|
| 80 | 1432 | 127 |
| 81 | 1390 | 124 |
| 82 | 1349 | 122 |
| 83 | 1310 | 119 |
| 84 | 1272 | 117 |
| 85 | 1235 | 115 |
| 86 | 1199 | 112 |
| 87 | 1163 | 110 |
| 88 | 1130 | 108 |
| 89 | 1097 | 106 |
| 90 | 1067 | 104 |
| 91 | 1038 | 102 |
| 92 | 1009 | 100 |
| 93 | 982 | 98 |
| 94 | 955 | 96 |
| 95 | 927 | 94 |
| 96 | 901 | 92 |
| 97 | 877 | 90 |
| 98 | 853 | 89 |
| 99 | 830 | 87 |

SUGGESTED FREQUENCY OUTPUT CIRCUITS

CIRCUIT

Note: R22=499kΩ/
 R4=49.9kΩ/R1=1kΩ/
 RV1=50kΩ potentiometer/
 C1=10nF/C2=2.2nF/C3=100nF



HTS2030SMD – Temperature and Relative Humidity Sensor

TYPICAL RESPONSE LOOK-UP TABLE (HUMIDITY OUTPUT)

| RH (%) | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
|-----------|------|------|------|------|------|------|------|------|------|------|------|
| Fout (Hz) | | | 7155 | 7080 | 7010 | 6945 | 6880 | 6820 | 6760 | 6705 | 6650 |
| RH (%) | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | |
| Fout (Hz) | 6600 | 6550 | 6500 | 6450 | 6400 | 6355 | 6305 | 6260 | 6210 | | |

QUALIFICATION PROCESS

HTS2030SMD sensors have been qualified through a complete qualification process taking in account many of the requirements of the JEDEC standard including:

- Solder heat and solderability including lead free process
- Pb free wave soldering and reflow soldering process(260 °C) + DI water clean at 45 °C
- Mechanical shock JESD-22-B104-A
- Vibration - Variable frequency (20 to 2000Hz) JESD-22-B103-A
- Marking permanency
- ESD - Electrostatic Discharge – Air Gun +/-15kV(IEC 1000)
- Salt Atmosphere JESD22-A107-A
- Temperature Cycling - 40 °C / +125 °C
- High Temperature / Humidity Operating Life - 93%RH / 60 °C for 1000 hours
- Low Humidity storage life - RH < 10%/23 °C for 1000 hours
- Resistance to immersion in water at ambient temperature and 80 °C
- High temperature storage 140 °C for 168 hours
- Resistance to many chemicals linked to home appliances/automotive or consumer applications

ENVIRONMENTAL AND RECYCLING

HTS2030SMD sensors are lead free components and are compatible with Pb Free soldering processes. HTS2030SMD sensors are free from Cr (6+), Cd and Hg.

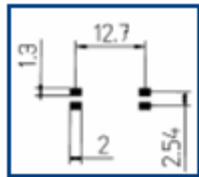
SOLDERING INSTRUCTIONS

We recommend taking specific attention to soldering conditions to get the best performance of MEAS-France/Humirel sensors. See Application Note. To get it, please contact: humirel.application@meas-spec.com

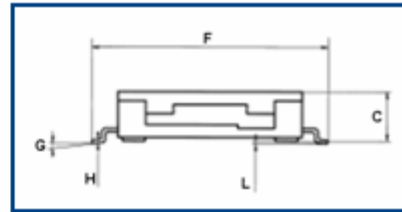
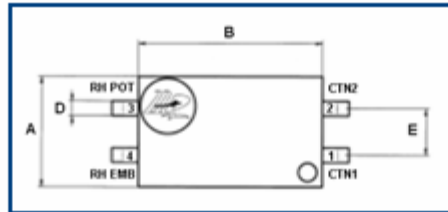
HTS2030SMD – Temperature and Relative Humidity Sensor

PACKAGE OUTLINE

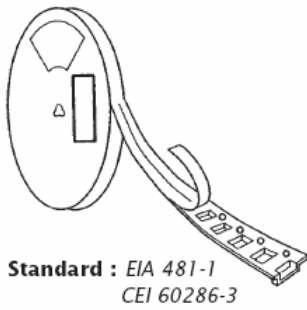
HTS2030SMD GULL WING
(JLEAD OPTION ALSO AVAILABLE)



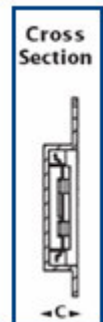
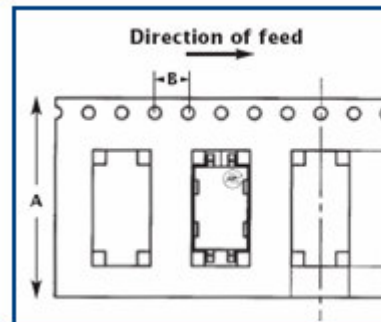
FOOTPRINT



| Dimension | A | B | C | D | E | F | G | H | L |
|-----------|---|----|-----|-----|------|------|------|-----|-----|
| mm | 6 | 10 | 2.7 | 0.8 | 2.54 | 13.4 | 0-7° | 0.2 | 0.1 |



| | | A | B | C |
|---------------|------------|--------------|--------------------|--------------------|
| Reel Diameter | Reel Width | Carrier Tape | Carrier Tape Pitch | Carrier Tape Depth |
| 360 mm | 30.4 mm | 24 mm | 4 mm | 4mm |



ORDERING INFORMATION

- HPP804B130: TUBE M.P.Q OF 78 PIECES
- HPP804B131: TAPE AND REEL M.P.Q OF 1500 PIECES

HTS2030SMD - TEMPERATURE AND RELATIVE HUMIDITY SENSOR

Customer Service contact details

Measurement Specialties, Inc.
105 av. du Général Eisenhower
BP 23705 31037 TOULOUSE CEDEX 1
FRANCE
Tél: +33 (0) 561 194 848
Fax: +33 (0) 561 194 553
Sales: humidity.sales@meas-spec.com

HTS2030SMD – Temperature and Relative Humidity Sensor

| Revision | Comments | Who | Date |
|----------|--|------------|-------------|
| B | RoHS logo added, Measurement Specialties logo updated, mechanical dimensions updated | D. LE GALL | December 07 |
| C | Pinout added on package outline schematic | D. LE GALL | January 08 |
| D | Standardized datasheet format | D. LE GALL | April 08 |
| E | Humidity sensor characteristic drawing updated | D. LE GALL | November 08 |

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