

TEMPERATURE AND RELATIVE HUMIDITY SENSOR HTS2030SMD
Meets RoHS regulations

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.

MAIN FEATURES

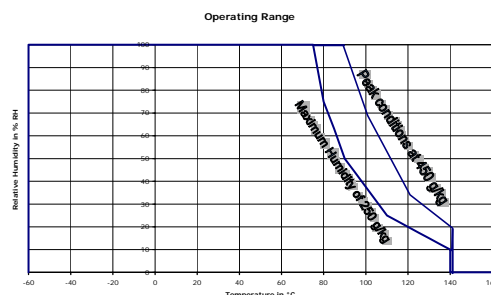
- Miniature Surface mount SMD package.
- Lead free components.
- Full interchangeability with no calibration required in standard conditions.
- Instantaneous desaturation after long periods in saturation phase.
- Compatible with automatized assembly processes, including **Pb free wave soldering and reflow processes** (1)
- High reliability and long term stability.
- Patented solid polymer structure.
- Suitable for linear voltage or frequency output circuitry.
- Fast response time and very low temperature coefficient.
- Part may be washed with distilled water.
- Individual marking for compliance to stringent traceability requirements.



(1) soldering temperature profiles available on request / contact us at sales@sensorway.cn

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 |



CHARACTERISTICS

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

| Characteristics | Symbol | Min. | Typ. | Max. | Unit. |
|---|-----------|------|--------|------|---------|
| Humidity measuring range | RH | 1 | | 99 | %RH |
| Supply voltage | Vs | | | 10 | V |
| Nominal capacitance @ 55% RH* | C | 177 | 180 | 183 | pF |
| Temperature coefficient | Tcc | | | 0.01 | pF/°C |
| Averaged Sensitivity from 33% to 75% RH | ΔC / % RH | | 0.31 | | pF/% RH |
| Leakage current (Vcc = 5 Volts) | I | | | 1 | nA |
| Recovery time after 150 hours of condensation | tr | | 10 | | s |
| Humidity Hysteresis | | | | +/-1 | %RH |
| Long term stability | τ | | +/-0.5 | | %RH/yr |
| Time constant (33 to 80 % RH, still air @ 63%) | ta | | 3 | 5 | s |
| Deviation to typical response curve (10% to 90%) RH | | | +/-2 | | %RH |

*tighter specification available on request

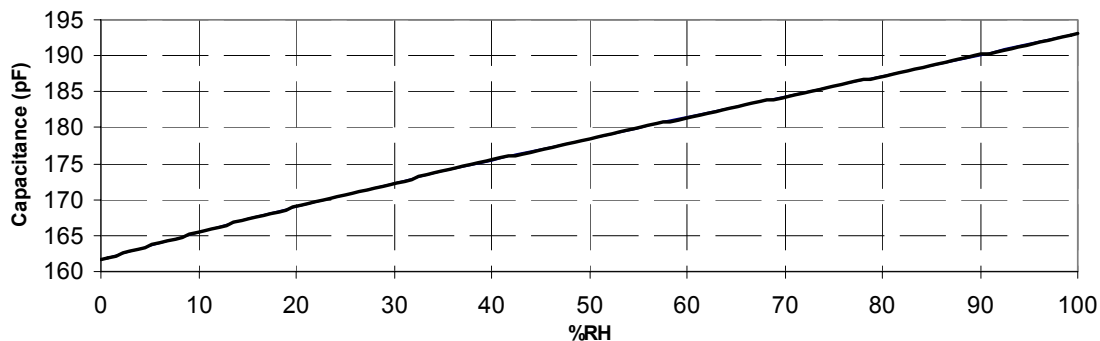
TYPICAL RESPONSE IN HUMIDITY

- Polynomial response of HTS2030SMD:

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

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 | |



- Reversed Polynomial response of HTS2030SMD:

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

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

CHARACTERISTICS

Temperature sensor

| Characteristics | Symbol | Min. | Typ | Max. | Unit. |
|--------------------------------------|--------|------|------|------|-------|
| Nominal resistance @ 25°C | | | 10 | | kΩ |
| Beta value : B25/100 | B | 3600 | 3730 | 3800 | |
| Temperature measuring range | Ta | -60 | | 140 | °C |
| Nominal Resistance Tolerance at 25°C | Rn | | 2 | 3 | % |
| B value tolerance | B | | 3 | | % |
| Response Time | T | | 10 | | s |

TYPICAL TEMPERATURE OUTPUT

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

$$\textcircled{1} \quad R_T = R_n * e^{B \left(\frac{1}{T} - \frac{1}{T_n} \right)}$$

R_T NTC resistance in Ω at temperature T in K

R_n NTC resistance in Ω at rated temperature in K

T, T_n Temperature in K

B B value, material-specific constant of the NTC thermistor

e Base of natural logarithm ($e = 2.71828$)

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

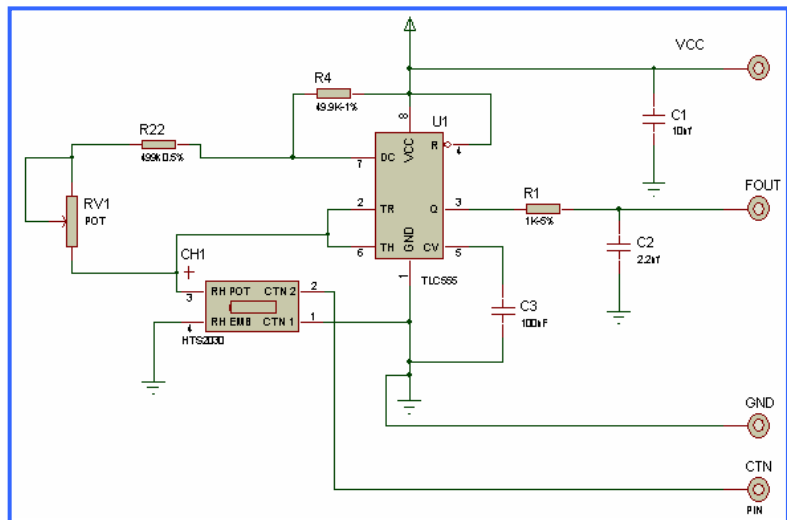
$\textcircled{2}$ For practical applications a more precise description of the real R/T curve may be required. Either more complicated approaches (e.g. the Steinhart-Hart equation) are used or the resistance/temperature relation as given in tabulated form. The below table has been experimentally determined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

Temperature look-up table

| Temp °C | Resistance (Ohm) | Max. deviation | Temp °C | Resistance (Ohm) | Max. deviation | Temp °C | Resistance (Ohm) | Max. deviation | Temp °C | Resistance (Ohm) | Max. deviation |
|---------|------------------|----------------|---------|------------------|----------------|---------|------------------|----------------|---------|------------------|----------------|
| -40 | 262960 | 35403 | -5 | 38279 | 2756 | 30 | 8178 | 296 | 65 | 2304 | 171 |
| -39 | 247217 | 32777 | -4 | 36455 | 2568 | 31 | 7866 | 294 | 66 | 2229 | 168 |
| -38 | 232539 | 30358 | -3 | 34731 | 2393 | 32 | 7568 | 292 | 67 | 2158 | 165 |
| -37 | 218845 | 28130 | -2 | 33100 | 2230 | 33 | 7283 | 290 | 68 | 2089 | 161 |
| -36 | 206064 | 26075 | -1 | 31557 | 2078 | 34 | 7011 | 287 | 69 | 2022 | 158 |
| -35 | 194110 | 24178 | 0 | 30029 | 1932 | 35 | 6734 | 284 | 70 | 1960 | 155 |
| -34 | 182852 | 22416 | 1 | 28627 | 1799 | 36 | 6484 | 281 | 71 | 1898 | 152 |
| -33 | 172332 | 20791 | 2 | 27299 | 1675 | 37 | 6244 | 278 | 72 | 1839 | 149 |
| -32 | 162498 | 19290 | 3 | 26042 | 1560 | 38 | 6015 | 275 | 73 | 1782 | 146 |
| -31 | 153299 | 17905 | 4 | 24852 | 1452 | 39 | 5796 | 271 | 74 | 1727 | 143 |
| -30 | 144790 | 16636 | 5 | 23773 | 1355 | 40 | 5575 | 267 | 75 | 1673 | 140 |
| -29 | 136664 | 15444 | 6 | 22708 | 1261 | 41 | 5373 | 264 | 76 | 1622 | 138 |
| -28 | 129054 | 14343 | 7 | 21698 | 1174 | 42 | 5180 | 260 | 77 | 1573 | 135 |
| -27 | 121925 | 13325 | 8 | 20739 | 1093 | 43 | 4995 | 257 | 78 | 1526 | 132 |
| -26 | 115243 | 12383 | 9 | 19829 | 1017 | 44 | 4817 | 253 | 79 | 1480 | 130 |
| -25 | 109030 | 11516 | 10 | 18959 | 946 | 45 | 4636 | 248 | 80 | 1432 | 127 |
| -24 | 103115 | 10705 | 11 | 18128 | 879 | 46 | 4473 | 245 | 81 | 1390 | 124 |
| -23 | 97565 | 9953 | 12 | 17338 | 817 | 47 | 4316 | 241 | 82 | 1349 | 122 |
| -22 | 92354 | 9257 | 13 | 16588 | 759 | 48 | 4166 | 237 | 83 | 1310 | 119 |
| -21 | 87460 | 8612 | 14 | 15876 | 705 | 49 | 4021 | 233 | 84 | 1272 | 117 |
| -20 | 82923 | 8020 | 15 | 15207 | 654 | 50 | 3874 | 229 | 85 | 1235 | 115 |
| -19 | 78581 | 7463 | 16 | 14569 | 607 | 51 | 3737 | 225 | 86 | 1199 | 112 |
| -18 | 74497 | 6947 | 17 | 13962 | 563 | 52 | 3606 | 221 | 87 | 1163 | 110 |
| -17 | 70655 | 6468 | 18 | 13384 | 522 | 53 | 3481 | 217 | 88 | 1130 | 108 |
| -16 | 67039 | 6023 | 19 | 12834 | 484 | 54 | 3360 | 213 | 89 | 1097 | 106 |
| -15 | 63591 | 5606 | 20 | 12280 | 447 | 55 | 3237 | 208 | 90 | 1067 | 104 |
| -14 | 60381 | 5222 | 21 | 11777 | 413 | 56 | 3126 | 204 | 91 | 1038 | 102 |
| -13 | 57356 | 4865 | 22 | 11297 | 382 | 57 | 3019 | 200 | 92 | 1009 | 100 |
| -12 | 54503 | 4533 | 23 | 10840 | 353 | 58 | 2917 | 197 | 93 | 982 | 98 |
| -11 | 51813 | 4225 | 24 | 10404 | 325 | 59 | 2819 | 193 | 94 | 955 | 96 |
| -10 | 49204 | 3932 | 25 | 10000 | 300 | 60 | 2720 | 189 | 95 | 927 | 94 |
| -9 | 46767 | 3662 | 26 | 9600 | 300 | 61 | 2629 | 185 | 96 | 901 | 92 |
| -8 | 44467 | 3411 | 27 | 9218 | 300 | 62 | 2542 | 182 | 97 | 877 | 90 |
| -7 | 42296 | 3177 | 28 | 8853 | 299 | 63 | 2458 | 178 | 98 | 853 | 89 |
| -6 | 40247 | 2960 | 29 | 8506 | 297 | 64 | 2378 | 175 | 99 | 830 | 87 |

SUGGESTED FREQUENCY OUTPUT CIRCUITS

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


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 - 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

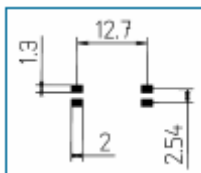
HTS2030SMD sensors are lead free components and are compatible with Pb Free soldering processes.HTS2030SMD sensors are free from Cr (6+), Cd and Hg.

SOLDERING INSTRUCTIONS

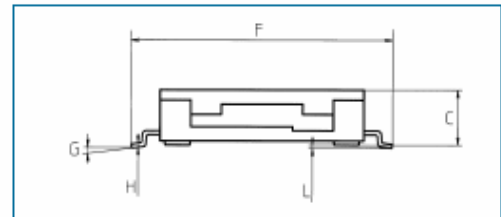
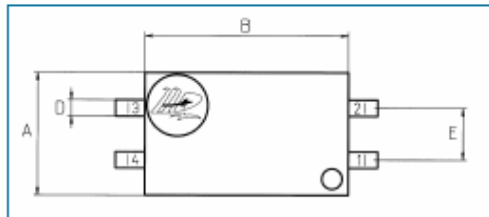
See Application Note. To get it, please contact: sales@sensorway.cn

PACKAGE OUTLINE HTS2030SMD GULL WING (JLEAD option also available)

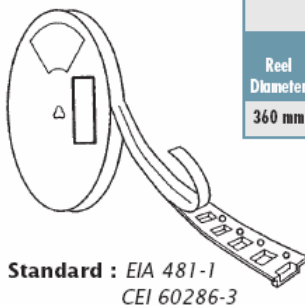
Dimensions in millimeters



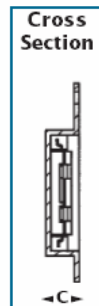
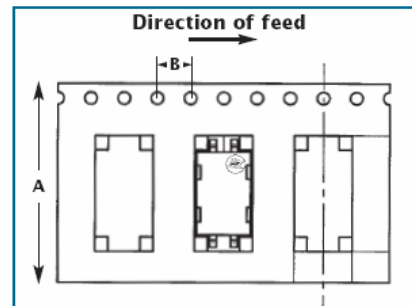
FOOTPRINT



| Dimension | A | B | C | D | E | F | G | H | L |
|--------------|---|----|-----|-----|------|------|------|-----|-----|
| mm (typical) | 6 | 10 | 2.7 | 0.8 | 2.54 | 12.8 | 0.7° | 0.2 | 0.1 |



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



ORDERING INFORMATION of HTS2030SMD:

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

TEMPERATURE AND RELATIVE HUMIDITY SENSORS.

The information in this sheet has been carefully reviewed and is believed to be accurate; however, no responsibility is assumed for inaccuracies. Furthermore, this information does not convey to the purchaser of such devices any license under the patent rights to the manufacturer. Humirel reserves the right to make changes without further notice to any product herein. Humirel makes no warranty, representation or guarantee regarding the suitability of its product for any particular purpose, nor does Humirel assume any liability arising out of the application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. « Typical » parameters can and do vary in different applications. All operating parameters, including « Typical » must be validated for each customer applications by customer's technical experts. Humirel does not convey any license under its patent rights nor the rights of others. Humirel products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other application intended to support or sustain life, or for any application in which the failure of the Humirel product could create a situation where personal injury or death may occur. Should buyer purchase or use Humirel products for any such unintended or unauthorized application, Buyer shall indemnify and hold Humirel and its officers, employees, subsidiaries, affiliates and distributors harmless against all claims, costs, damages and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Humirel was negligent regarding the design or manufacture of the part.Humirel is a registered trade mark of Humirel.