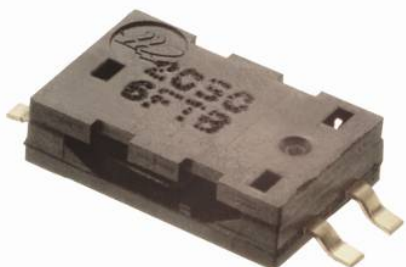


## HTS2030SMD – Temperature and Relative Humidity Sensor



- 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 <sup>(1)</sup>
- 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

### APPLICATIONS

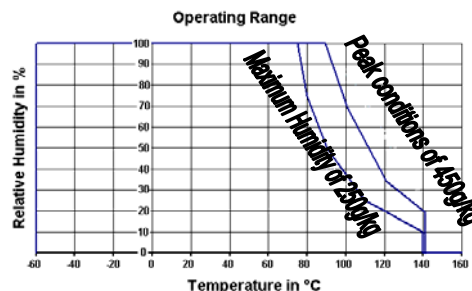
- Automotive
- Home Appliance
- Printers
- Meteorology

### 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 <sup>(1)</sup>	C	177	180	183	pF
Temperature coefficient	T <sub>cc</sub>			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

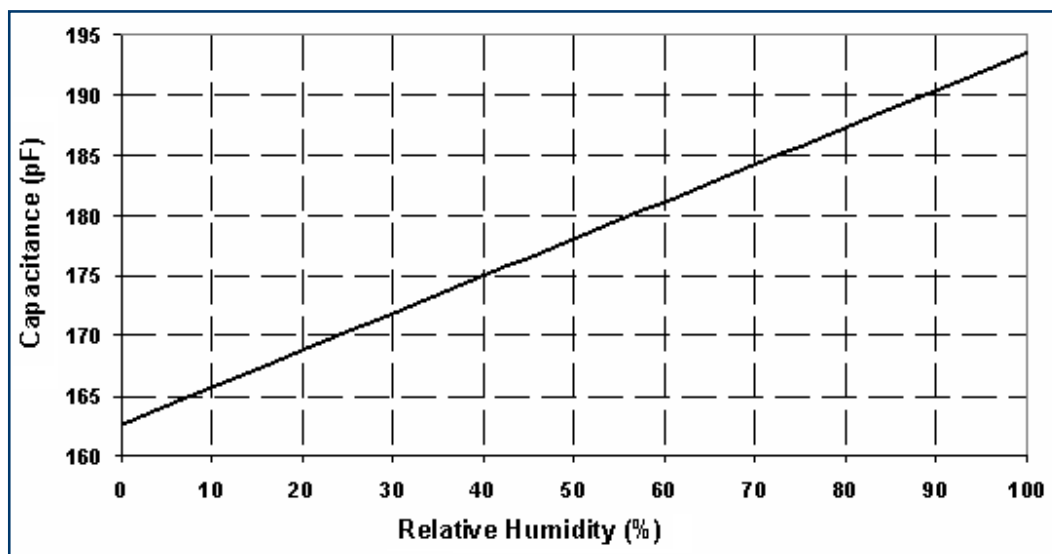
Temperature Characteristics	Symbol	Min	Typ	Max	Unit
Nominal Resistance @25°C	R		10		kΩ
Beta value: B25/100	β	3600	3730	3800	
Temperature Measuring Range	Ta	-60		140	°C
Nominal Resistance Tolerance @25°C	R <sub>N</sub>		2	3	%
Beta Value Tolerance	β		3		%
Response Time	τ		10		s

### 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 $\Omega$ at temperature T in K
$R_N$	NTC resistance in $\Omega$ at rated temperature T in K
T, $T_N$	Temperature in K
$\beta$	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  $\beta$  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 Application Note HPC106 “Low power NTC measurement”.

## HTS2030SMD – Temperature and Relative Humidity Sensor

### • Temperature look-up table

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

### • Steinhart-Hart coefficients

According to the equation below, the Steinhart-Hart coefficients for the operating temperature range for HTS2030SMD thermistor are:

$$\frac{1}{T} = a + b * \ln(R) + C * \ln(R) * \ln(R) * \ln(R)$$

R NTC resistance in Ω at temperature T in K

T Temperature in K

a Constant value (a= 9.94805E-04)

b Constant value (b= 2.46791E-04)

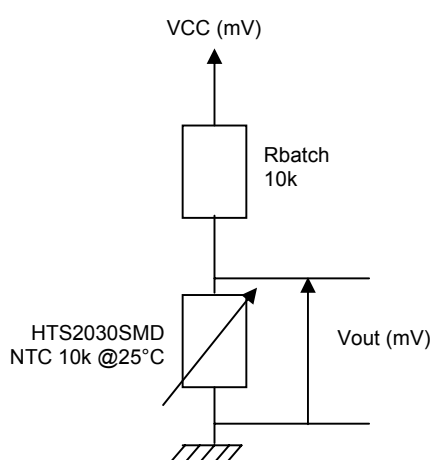
c Constant value (c= 1.10298E-07)

## HTS2030SMD – Temperature and Relative Humidity Sensor

### • Temperature Interface circuit

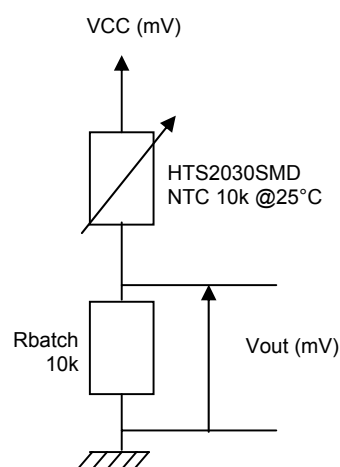
Concerning the temperature sensor of the HTS2030SMD, the following measuring method described below is based on a voltage bridge divider circuit. It uses only one resistor component (Rbatch) at 1% to design HTS2230 temperature sensor interfacing circuit. Rbatch is chosen to be equal to NTC @25°C to get:  $V_{out} = V_{cc}/2$  @25°C. There are two proposal configurations: If Rbatch is connected to Vcc and NTC to Ground, it leads to a negative slope characteristic (Pull-Down Configuration). For a positive slope, Rbatch and NTC resistors have to be switched (Pull-Up Configuration).

#### Pull-Up Configuration



$$V_{OUT} (mV) = \frac{V_{cc}(mV) * NTC_{HTS2030SMD} (\Omega)}{R_{batch} (\Omega) + NTC_{HTS2030SMD} (\Omega)}$$

#### Pull-Down Configuration



$$V_{OUT} (mV) = \frac{V_{cc}(mV) * R_{batch} (\Omega)}{R_{batch} (\Omega) + NTC_{HTS2030SMD} (\Omega)}$$

Temperature conversion: look-up table (Vcc=5Vdc)

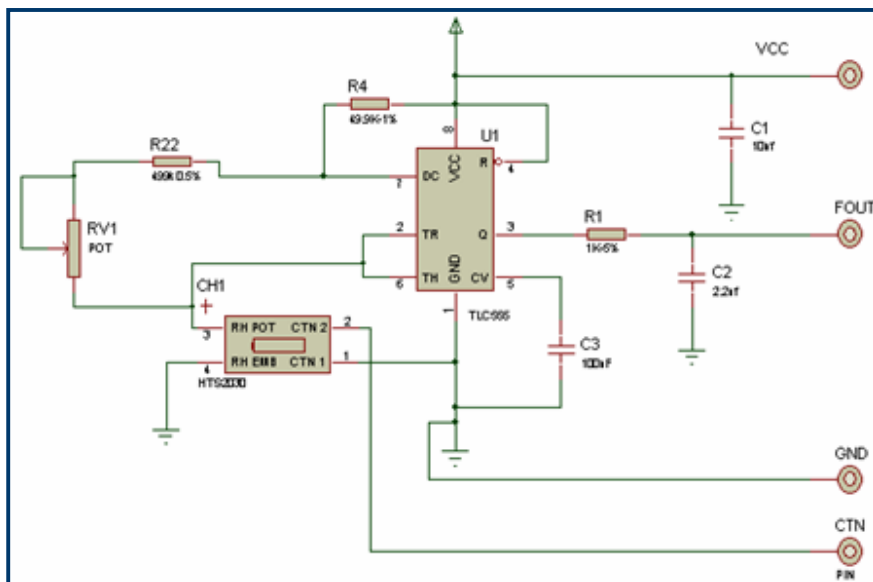
Temperature (°C)	Resistance (Ω)	Pull-Up Configuration Vout (mV)	Pull-Down Configuration Vout (mV)
-40	262960	4817	183
-30	144790	4677	323
-20	82923	4462	538
-10	49204	4155	845
0	30029	3751	1249
10	18959	3273	1727
20	12280	2756	2244
25	10000	2500	2500
30	8178	2249	2751
40	5575	1790	3210
50	3874	1396	3604
60	2720	1069	3931
70	1960	819	4181
80	1432	626	4374
90	1067	482	4518
99	830	383	4617

## HTS2030SMD – Temperature and Relative Humidity Sensor

### SUGGESTED FREQUENCY OUTPUT CIRCUITS

#### CIRCUIT

Note: R22=499k $\Omega$ /  
 R4=49.9k $\Omega$ /R1=1k $\Omega$ /  
 RV1=50k $\Omega$  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 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

## HTS2030SMD – Temperature and Relative Humidity Sensor

### ENVIRONMENTAL AND RECYCLING

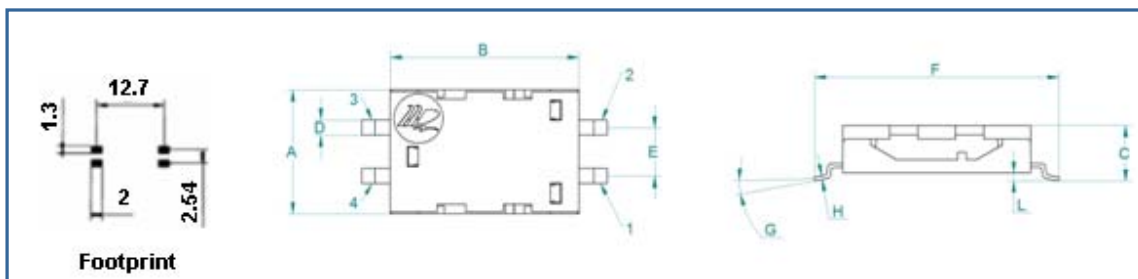
HTS2030SMD sensors are lead free components and are compatible with Pb Free soldering processes. HTS2030SMD sensors are free from Cr (6+), Cd and Hg.

### SOLDERING INSTRUCTIONS

We recommend taking specific attention to soldering conditions to get the best performance of MEAS-France sensors. See Application Note. To get it, please contact:

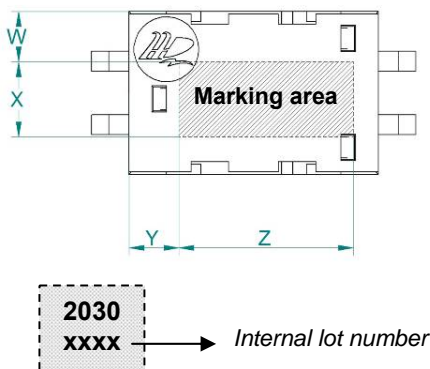
### PACKAGE OUTLINE

HTS2030SMD GULL WING  
(JLEAD OPTION ALSO AVAILABLE)



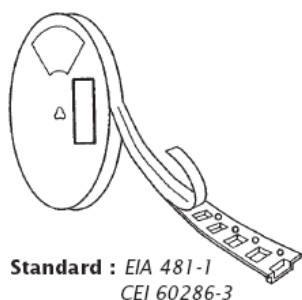
#### Pin Out Assignment

N°	Function
1	CTN1
2	CTN2
3	RH POT
4	RH EMB

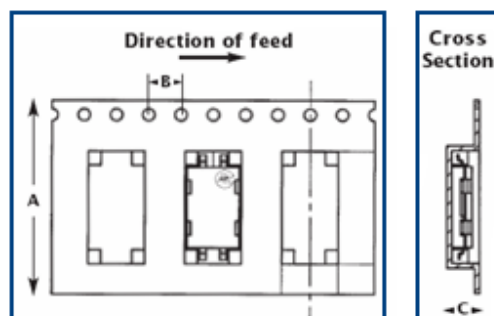


Dimension	mm
A	6 ± 0.25
B	10 ± 0.25
C	2.7 ± 0.2
D	0.8 ± 0.1
E	2.54 ± 0.1
F	13.6 ± 0.1
G	0-10°
H	0.2 ± 0.05
L	0.15 ± 0.1
W	2 ± 0.25
X	3 ± 0.25
Y	2 ± 0.25
Z	6 ± 0.25

## HTS2030SMD – Temperature and Relative Humidity Sensor



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



### 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

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
F	Package outline paragraph updated	D. LE GALL	June 09
G	Steinhart-Hart equation and temperature interface circuit added, Pinout added	D. LE GALL	July 09