

## 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.

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### MAIN FEATURES

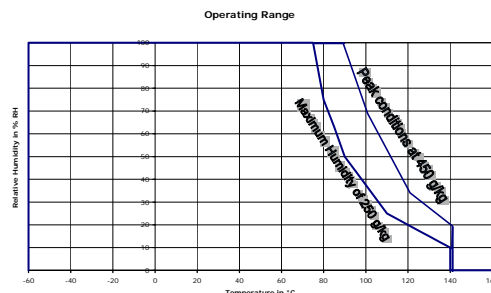
- Miniature Surface mount SMD package.
- Lead free components.
- Full interchangeability with no calibration required in standard conditions.
- Instantaneous desaturation after long periods in saturation phase.
- Compatible with automatized assembly processes, including **Pb free wave soldering and reflow 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 [application@humirel.com](mailto:application@humirel.com)



### 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	$\Delta C / \% RH$		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	$\tau$		+/-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

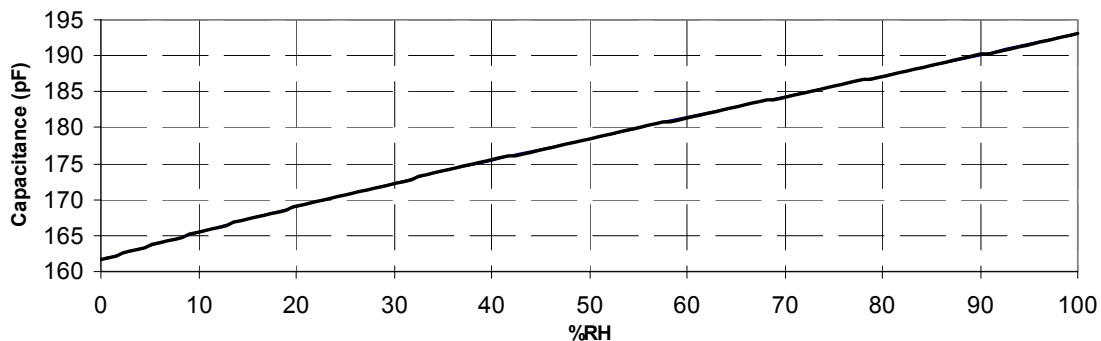
## TYPICAL RESPONSE IN HUMIDITY

- 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	τ		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.

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

$R_T$  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.

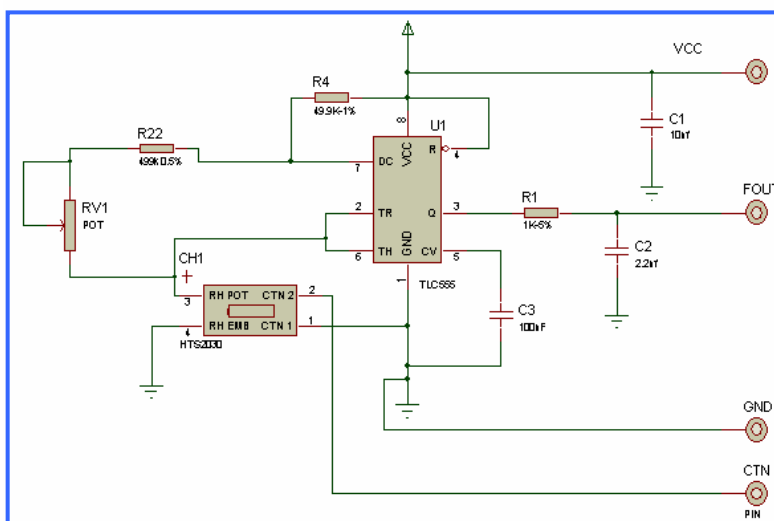
② For practical applications a more precise description of the real R/T curve may be required. Either more complicated approaches (e.g. the Steinhart-Hart equation) are used or the resistance/temperature relation as given in tabulated form. The below table has been experimentally determined with utmost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

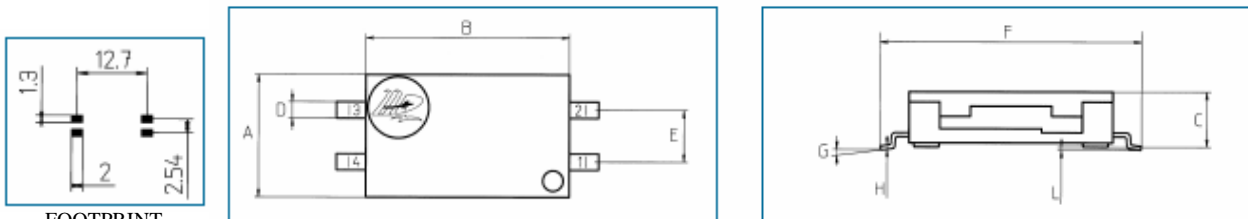
HTS2030SMD sensors are lead free components and are compatible with Pb Free soldering processes.HTS2030SMD sensors are free from Cr (6+), Cd and Hg.

## SOLDERING INSTRUCTIONS

See Application Note. To get it, please contact: [application@humirel.com](mailto:application@humirel.com)

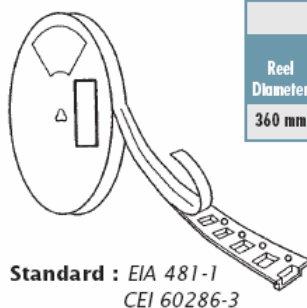
## PACKAGE OUTLINE HTS2030SMD GULL WING (JLEAD option also available)

Dimensions in millimeters

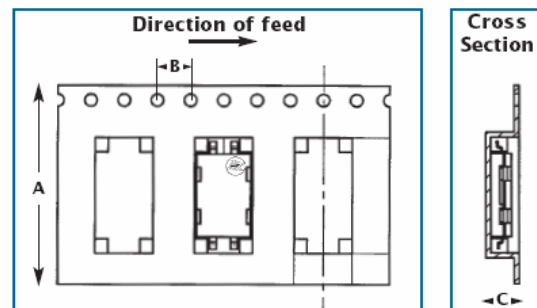


FOOTPRINT

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	4 mm	4 mm
Carrier Tape	24 mm	4 mm	4 mm
Carrier Tape Pitch			
Carrier Tape Depth			



### 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.

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