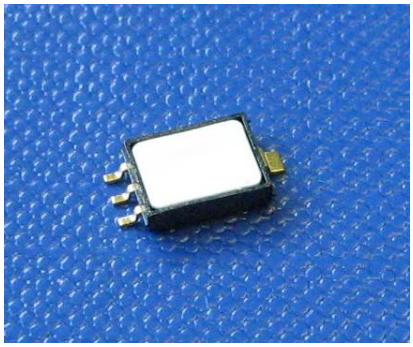
HTS2230 – Miniature Temperature and Relative Humidity Sensor



- **Miniature Surface mount SMD package**
- **Linear response from 0 to 100%RH**
- **Lead free component**
- **Patented solid polymer structure**
- **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

- Fulll 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

APPLICATIONS

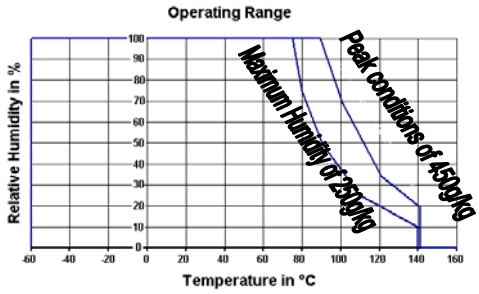
- Automotive
- Home Appliance
- Printers
- Meteorology
- Radiosondes, weather balloon

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.



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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	67	68	69	pF
Temperature coefficient (15°C-45°C)	T_{cc}		+/- 0.03		%RH/°C
Average Sensitivity from 33% to 75%RH	ΔC/%RH		0.13		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		1	3	s
Deviation to typical response curve (10% RH to 90%RH)			+/-3		%RH

(1) Tighter specification available on request

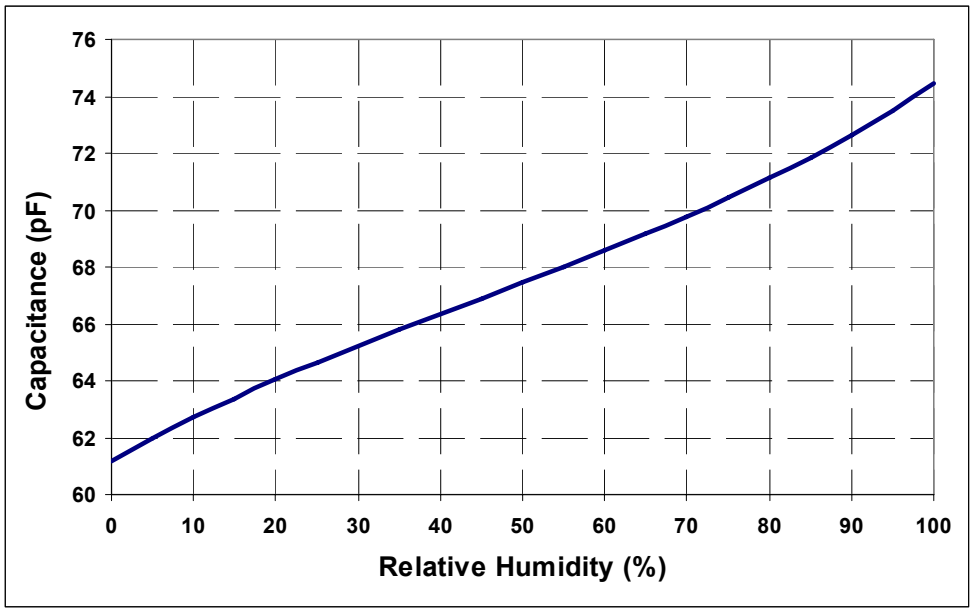
Temperature Characteristics	Symbol	Min	Typ	Max	Unit
Nominal Resistance @25°C	R		10		kΩ
Beta value: B25/50	β	3347	3380	3413	K
Temperature Measuring Range	Ta	-40		125	°C
Nominal Resistance Tolerance @25°C	R_N			1	%
Beta Value Tolerance	β		1		%
Response Time	τ		10		s

TYPICAL PERFORMANCE CURVES

HUMIDITY SENSOR

- **Polynomial Response**

Cp (pF) = 9.07 10^{-6} RH^3 – 1.22 10^{-3} RH^2 + 1.64 10^{-1} RH + 61.2 *(with RH in %)*



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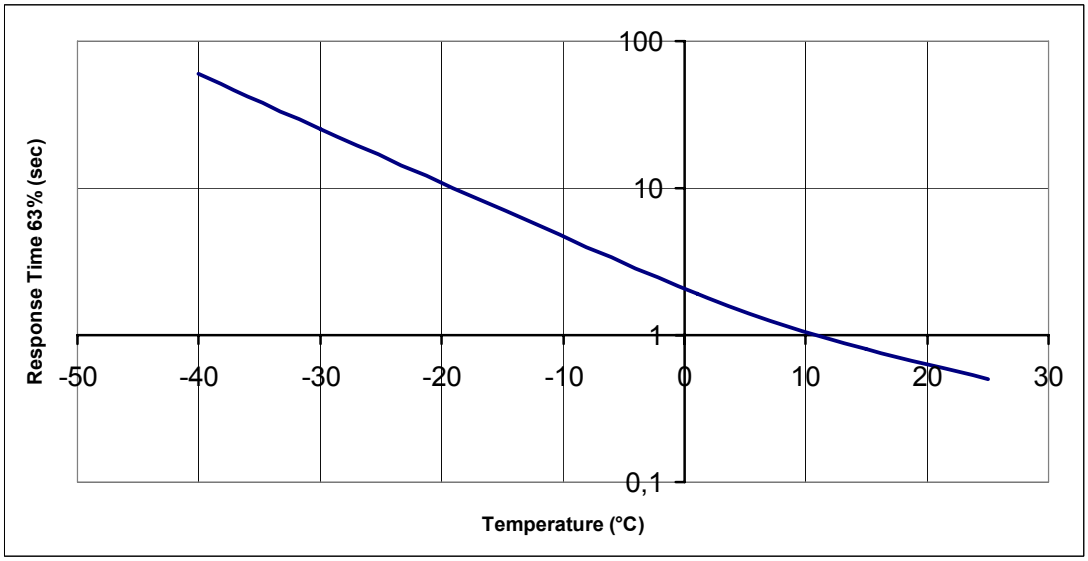
- **Typical Response Look-Up Table (Polynomial reference curve) @10kHz/1V**

RH (%)	0	5	10	15	20	25	30	35	40	45	50
Cp (pF)		62.0	62.7	63.4	64.0	64.6	65.2	65.8	66.4	66.9	67.4
RH (%)	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**	
Cp (pF)	68.0	68.6	69.2	69.8	70.4	71.1	71.9	72.7	73.5		

- **Reverse Polynomial Response**

RH (%) = -3.15195 10^{-2} C^3 + 6.3301 C^2 – 414.86 C+ 8905.3 ***(with C in pF)***

- **Response Time Vs Temperature**



Condition: Airflow 1 m/s; 63%of signal.

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”.

- **Temperature look-up table**

Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)
-40	195652	5	22021	50	4161	95	1110
-39	184917	6	21123	51	4026	96	1081
-38	174845	7	20267	52	3896	97	1053
-37	165391	8	19450	53	3771	98	1026
-36	156513	9	18670	54	3651	99	999
-35	148171	10	17926	55	3535	100	974
-34	140330	11	17214	56	3423	101	949
-33	132958	12	16534	57	3315	102	925
-32	126022	13	15886	58	3211	103	902
-31	119494	14	15266	59	3111	104	880
-30	113347	15	14674	60	3014	105	858
-29	107565	16	14108	61	2922	106	837
-28	102116	17	13566	62	2834	107	816
-27	96978	18	13049	63	2748	108	796
-26	92132	19	12554	64	2666	109	777
-25	87559	20	12081	65	2586	110	758
-24	83242	21	11628	66	2509	111	740
-23	79166	22	11195	67	2435	112	722
-22	75316	23	10780	68	2364	113	705
-21	71677	24	10382	69	2294	114	688
-20	68237	25	10000	70	2228	115	672
-19	64991	26	9634	71	2163	116	656
-18	61919	27	9284	72	2100	117	640
-17	59011	28	8947	73	2040	118	625
-16	56258	29	8624	74	1981	119	611
-15	53650	30	8315	75	1925	120	596
-14	51178	31	8018	76	1870	121	583
-13	48835	32	7734	77	1817	122	569
-12	46613	33	7461	78	1766	123	556
-11	44506	34	7199	79	1716	124	544
-10	42506	35	6948	80	1669	125	531
-9	40600	36	6707	81	1622		
-8	38791	37	6475	82	1578		
-7	37073	38	6253	83	1535		
-6	35442	39	6039	84	1493		
-5	33892	40	5834	85	1452		
-4	32420	41	5636	86	1413		
-3	31020	42	5445	87	1375		
-2	29689	43	5262	88	1338		
-1	28423	44	5086	89	1303		
0	27219	45	4917	90	1268		
1	26076	46	4754	91	1234		
2	24988	47	4597	92	1202		
3	23951	48	4446	93	1170		
4	22963	49	4301	94	1139		

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PROCESS

HTS2230 sensors have been tested through a complete sequence 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
- ESD - Electrostatic Discharge – Air Gun +-10kV(IEC 1000)
- Salt Atmosphere JESD22-A107-A
- Temperature Cycling - 40°C / +125°C for 168 hours
- High Temperature / Humidity Operating Life - 93%RH / 60°C for 168 hours
- Low Humidity storage life - RH < 10%/23°C for 168 hours
- Resistance to immersion in water at ambient temperature and 80°C
- High temperature storage 120°C for 168 hours
- Resistance to many chemicals linked to home appliances/automotive or consumer applications

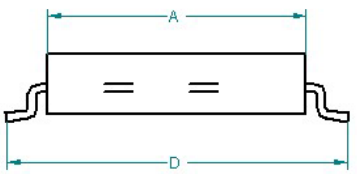
ENVIRONMENTAL AND RECYCLING

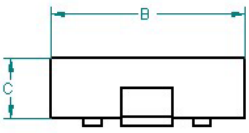
HTS2230 sensors are lead free components and are compatible with Pb Free soldering processes.
HTS2230 sensors are free from Cr (6+), Cd and Hg.

SOLDERING INSTRUCTIONS

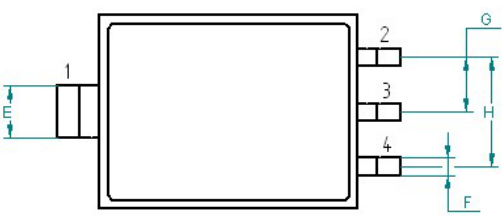
We recommend taking specific attention to soldering conditions to get the best performance of MEAS-France/Humirel sensors. See Application Note.

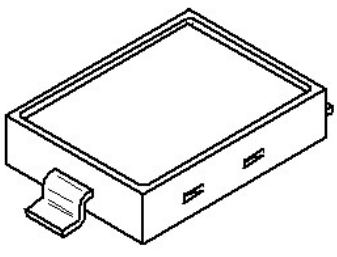
PACKAGE OUTLINE





Dim	Typ (mm)
A	6.00 ± 0.25
B	4.50 ± 0.25
C	1.40 ± 0.25
D	7.91 ± 0.30
E	1.20 ± 0.10
F	0.40 ± 0.10
G	1.27 ± 0.10
H	2.54 ± 0.20





Pin Out Assignment

N°	Function
1	Sensor -
2	Sensor +
3	NTC1
4	NTC2

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