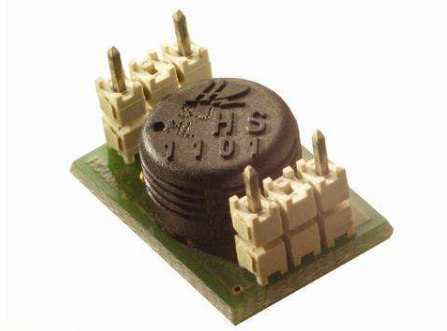


HTF3000LF – Temperature and Relative Humidity Module



- Small size product
- Compliant with RoHS recommendations and most of Lead Free Soldering Process
- Humidity calibrated within $\pm 3\%$ @55%RH at 5Vdc
- Stable, proportional frequency output from 0 to 100% RH
- High quality thermistor

DESCRIPTION

Based on the rugged HS1101LF humidity sensor, HTF3000LF is a dedicated humidity and temperature transducer designed for OEM applications where a reliable and accurate measurement is needed. It features a very small size for easy, cost-effective mechanical mounting. Direct interface with a micro-controller is made possible with the module's linear frequency output.

FEATURES

- | | |
|---|--|
| <ul style="list-style-type: none"> • One of the smallest humidity/temperature modules on the market • High reliability and long term stability • Not affected by water immersion • Stable characteristics with temperature • Part could be washed with distilled water | <p>Humidity Sensor Specific Features</p> <ul style="list-style-type: none"> • Instantaneous de-saturation after long periods in saturation phase • Fast response time • High resistance to chemicals • Patented solid polymer structure <p>Temperature Sensor Specific Features</p> <ul style="list-style-type: none"> • 10kΩ $\pm 1\%$ NTC temperature sensor • Stable • High sensitivity |
|---|--|

APPLICATIONS

- Printers
- HVAC controller

...

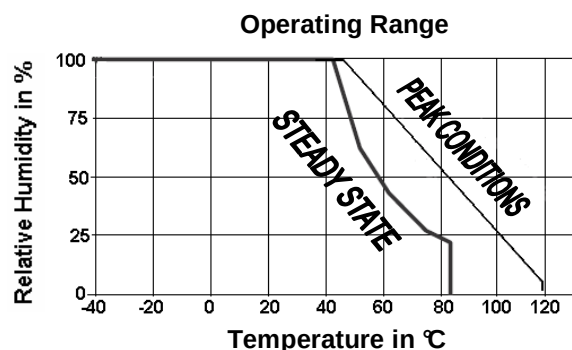
HTF3000LF - Temperature and Relative Humidity Module

PERFORMANCE SPECS

MAXIMUM RATINGS

Ratings	Symbol	Value	Unit
Storage Temperature	Tstg	-40 to 105	°C
Storage Humidity	RHstg	0 to 100	% RH
Supply Voltage (Peak)	Vs	16	Vdc
Humidity Operating Range	RH	0 to 100	% RH
Temperature Operating Range	Ta	-40 to 85	°C

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



ELECTRICAL CHARACTERISTICS

(Ta=23°C, Vs=5Vdc +/-5%, RL>1MΩ unless otherwise stated)

Humidity Characteristics	Symbol	Min	Typ	Max	Unit
Humidity Measuring Range	RH	0		100	%RH
Relative Humidity Accuracy (0 to 100% RH)	RH	Refer to Chart 2 on page 3			%RH
Supply Voltage	Vs	3	5	8	Vdc
Nominal Output @55%RH (at 5Vdc)	Fout	6560	6600	6640	Hz
Current consumption (Max at 16Vdc)	Ic		0.18	1	mA
Supply Voltage Influence (3 to 7Vdc)	RH		+/-1		% RH
Average Sensitivity from 10% to 95%RH	$\Delta F_{out}/\Delta RH$	-10	-12	-14	Hz/%RH
Humidity Hysteresis				+/-1	%RH
Long Term Stability	T		+/-0.5		%RH/yr
Time Constant (at 63% of signal, static) 40% to 95%RH, 2m/s	τ			10	s

(Ta=25°C)

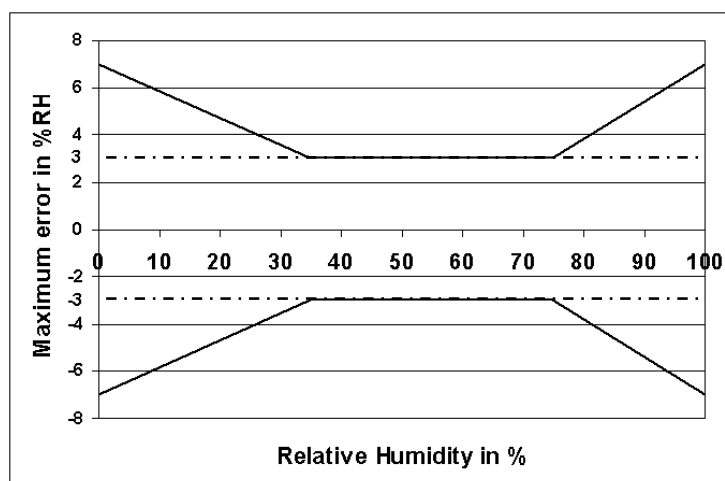
Temperature Characteristics	Symbol	Min	Typ	Max	Unit
Nominal Resistance @25°C	R		10		kΩ
Beta value: B25/100	β	3346	3380	3413	
Temperature Measuring Range	Ta	-40		85	°C
Nominal Resistance Tolerance @25°C	R _N		1		%
Beta Value Tolerance	β		1		%
Response Time	τ		10		s

HTF3000LF - Temperature and Relative Humidity Module

TYPICAL PERFORMANCE CURVES

HUMIDITY SENSOR

- Relative Humidity Accuracy of HTF3000LF @23℃



- Modeled Signal Output Equations

$$F_{out} = 7314 - 16.79 \cdot RH + 0.0886 \cdot RH^2 - 0.000358 \cdot RH^3$$

F_{out} in Hz and RH in %

- Modeled Reversed Output Equations

$$RH = 89.8 \cdot 10^{-10} \cdot F_{out}^3 - 15.7486 \cdot 10^{-5} \cdot F_{out}^2 + 0.80945 \cdot F_{out} - 1009$$

F_{out} in Hz and RH in %

- Typical response look-up table

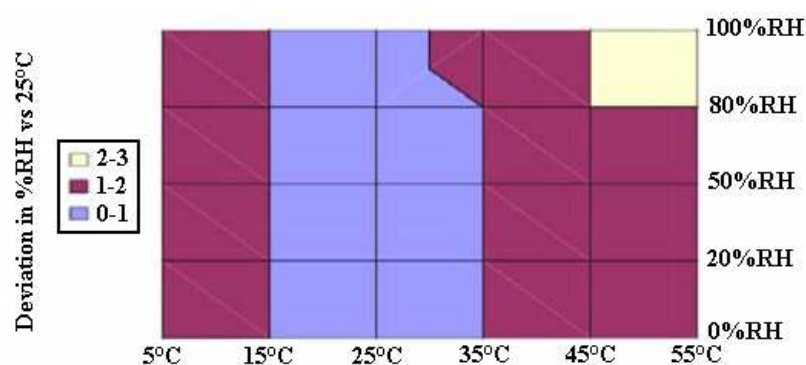
RH (%)	1	5	10	15	20	25	30	35	40	45	50
Fout (Hz)	7295	7230	7155	7080	7010	6945	6880	6820	6760	6705	6650
RH (%)	55	60	65	70	75	80	85	90	95	99	
Fout (Hz)	6600	6550	6500	6450	6400	6355	6305	6260	6210	6170	

Output Voltage wave form



HTF3000LF - Temperature and Relative Humidity Module

- Temperature influence on HTF3000LF humidity measurement



Calibration data are traceable to NIST standards through CETIAT laboratory.

For demanding application, temperature coefficient could be compensated over operating temperature range using following formula:

$$\begin{aligned} RH_{\text{corr}} &= RH + 0.08 * (T - 25) \\ F_{\text{out corr}} &= F_{\text{out}} - 0.88 * (T - 25) \\ T \text{ in } ^\circ\text{C}, RH \text{ in } \%, F_{\text{out}} \text{ in } \text{Hz} \end{aligned}$$

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.

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

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 Application Note HPC106-0 "Low power NTC measurement".

HTF3000LF - Temperature and Relative Humidity Module

• Temperature Look-up Table

Temp (°C)	Rout (Ω)	Max Dev (Ω)
-40	195652	7921
-39	184917	7378
-38	174845	6874
-37	165391	6407
-36	156513	5974
-35	148171	5571
-34	140330	5197
-33	132958	4849
-32	126022	4527
-31	119494	4226
-30	113347	3947
-29	107565	3687
-28	102116	3446
-27	96978	3221
-26	92132	3011
-25	87559	2815
-24	83242	2633
-23	79166	2463
-22	75316	2305
-21	71677	2157
-20	68237	2019
-19	64991	1890
-18	61919	1770
-17	59011	1658
-16	56258	1553
-15	53650	1454
-14	51178	1363
-13	48835	1277
-12	46613	1197
-11	44506	1121
-10	42506	1051
-9	40600	985
-8	38791	923
-7	37073	865
-6	35442	810
-5	33892	759
-4	32420	712
-3	31020	667
-2	29689	625
-1	28423	586
0	27219	549
1	26076	514

Temp (°C)	Rout (Ω)	Max Dev (Ω)
2	24988	482
3	23951	452
4	22963	423
5	22021	396
6	21123	371
7	20267	348
8	19450	326
9	18670	305
10	17926	285
11	17214	267
12	16534	250
13	15886	233
14	15266	218
15	14674	204
16	14108	190
17	13566	178
18	13049	166
19	12554	154
20	12081	144
21	11628	134
22	11195	125
23	10780	116
24	10382	108
25	10000	100
26	9634	100
27	9284	100
28	8947	100
29	8624	99
30	8315	99
31	8018	98
32	7734	98
33	7461	97
34	7199	96
35	6948	95
36	6707	94
37	6475	93
38	6253	92
39	6039	91
40	5834	90
41	5636	89
42	5445	88
43	5262	87

Temp (°C)	Rout (Ω)	Max Dev (Ω)
44	5086	86
45	4917	85
46	4754	83
47	4597	82
48	4446	81
49	4301	80
50	4161	79
51	4026	77
52	3896	76
53	3771	75
54	3651	74
55	3535	73
56	3423	72
57	3315	70
58	3211	69
59	3111	68
60	3014	67
61	2922	66
62	2834	65
63	2748	64
64	2666	63
65	2586	62
66	2509	60
67	2435	59
68	2364	58
69	2294	57
70	2228	56
71	2163	55
72	2100	54
73	2040	53
74	1981	52
75	1925	52
76	1870	51
77	1817	50
78	1766	49
79	1716	48
80	1669	47
81	1622	46
82	1578	46
83	1535	45
84	1493	44
85	1452	43

HTF3000LF - Temperature and Relative Humidity Module

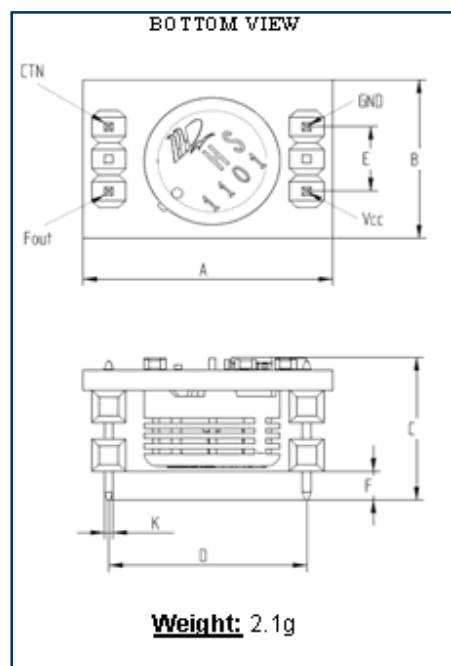
QUALIFICATION PROCESS

RESISTANCE TO PHYSICAL AND CHEMICAL STRESSES

- HTF3000LF has passed through qualification processes of MEAS-France including vibration, shock, storage, high temperature and humidity.
- Additional tests under harsh chemical conditions demonstrate good operation in presence of salt atmosphere, SO₂ (0.5%), H₂S (0.5%), O₃, NO_x, NO, CO, CO₂, Softener, Soap, Toluene, acids (H₂SO₄, HNO₃, HCl), HMDS, Insecticide, Cigarette smoke, this is not an exhaustive list.
- ESD: HTF3000LF is able to sustain a minimum of +/-8kV (contact discharge).

PACKAGE OUTLINE

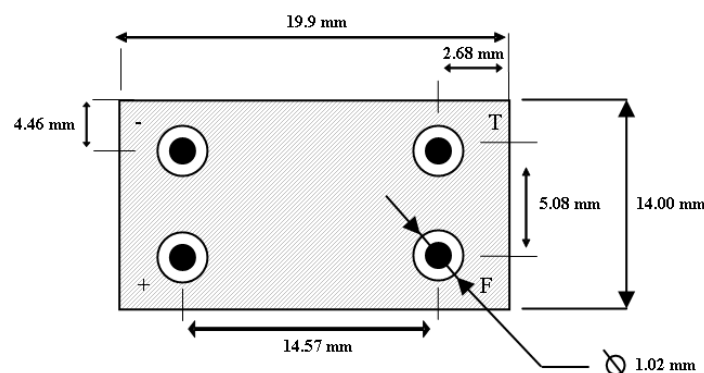
HTF3000LF PVH



Dim	A	B	C	D	E	F	K
Min	17.9	12.0	10.7	14.25	4.80	1.76	0.54
Max	18.9	13.0	11.7	14.95	5.40	3.76	0.74

Dimensions in millimeters

RECOMMENDED THROUGH HOLE FOOTPRINT



HTF3000LF - Temperature and Relative Humidity Module

SOLDERING INFORMATION

HTF3000LF PVH: Hand soldering or wave soldering

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