

HTF3000LF – Temperature and Relative Humidity Module



- Small size product
- Compliant with RoHS recommendations and most of Lead Free Soldering Process
- Humidity calibrated within +/-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

- 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
- Humidity Sensor Specific Features**
- Instantaneous de-saturation after long periods in saturation phase
 - Fast response time
 - High resistance to chemicals
 - Patented solid polymer structure
- Temperature Sensor Specific Features**
- 10kΩ +/-1% NTC temperature sensor
 - Stable
 - High sensitivity

APPLICATIONS

- Printers
- HVAC controller

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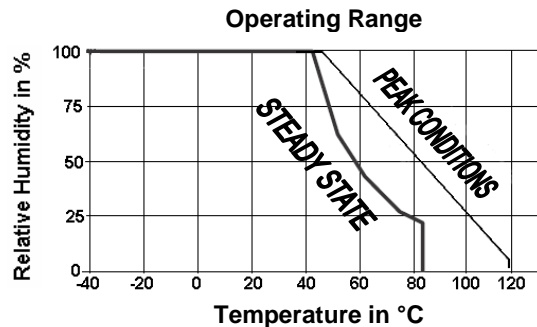
HTF3000LF - Temperature and Relative Humidity Module

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)

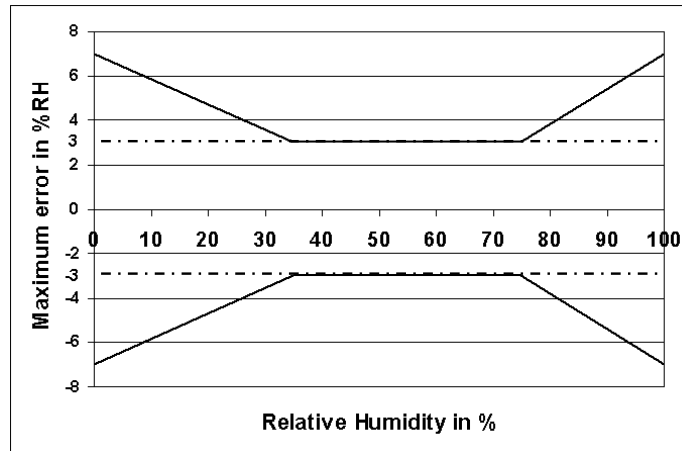
Temperature Characteristics	Symbol	Min	Typ	Max	Unit
Nominal Resistance @25°C	R		10		kΩ
Beta value: B25/100	β	3346	3380	3413	
Temperature Measuring Range	Ta	-40		85	°C
Nominal Resistance Tolerance @25°C	R _N		1		%
Beta Value Tolerance	β		1		%
Response Time	τ		10		s

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TYPICAL PERFORMANCE CURVES

HUMIDITY SENSOR

- Relative Humidity Accuracy of HTF3000LF @23°C



- Modeled Signal Output Equation

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

F_{out} in Hz and RH in %

- Modeled Reversed Output Equation

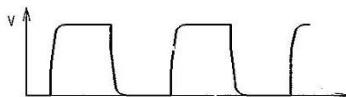
$$RH = 89.8 \cdot 10^{-10} \cdot F_{out}^3 - 15.7486 \cdot 10^{-5} \cdot F_{out}^2 + 0.80945 \cdot F_{out} - 1009$$

F_{out} in Hz and RH in %

- Typical response look-up table

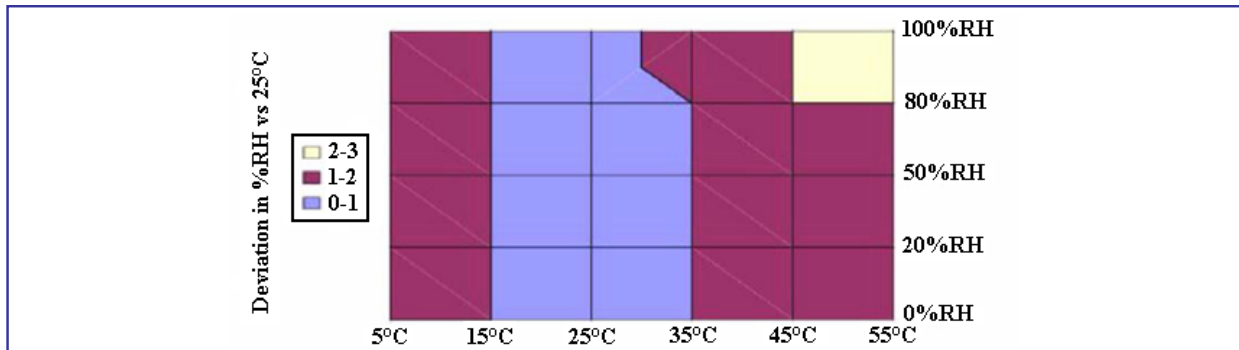
RH (%)	1	5	10	15	20	25	30	35	40	45	50
Fout (Hz)	7295	7230	7155	7080	7010	6945	6880	6820	6760	6705	6650
RH (%)	55	60	65	70	75	80	85	90	95	99	
Fout (Hz)	6600	6550	6500	6450	6400	6355	6305	6260	6210	6170	

Output Voltage wave form



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- 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:

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

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".

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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	195652	7921	2	24988	482	44	5086	86	86	1413	42
-39	184917	7378	3	23951	452	45	4917	85	87	1375	42
-38	174845	6874	4	22963	423	46	4754	83	88	1338	41
-37	165391	6407	5	22021	396	47	4597	82	89	1303	40
-36	156513	5974	6	21123	371	48	4446	81	90	1268	39
-35	148171	5571	7	20267	348	49	4301	80	91	1234	39
-34	140330	5197	8	19450	326	50	4161	79	92	1202	38
-33	132958	4849	9	18670	305	51	4026	77	93	1170	37
-32	126022	4527	10	17926	285	52	3896	76	94	1139	37
-31	119494	4226	11	17214	267	53	3771	75	95	1110	36
-30	113347	3947	12	16534	250	54	3651	74	96	1081	35
-29	107565	3687	13	15886	233	55	3535	73	97	1053	35
-28	102116	3446	14	15266	218	56	3423	72	98	1026	34
-27	96978	3221	15	14674	204	57	3315	70	99	999	34
-26	92132	3011	16	14108	190	58	3211	69	100	974	33
-25	87559	2815	17	13566	178	59	3111	68	101	949	32
-24	83242	2633	18	13049	166	60	3014	67	102	925	32
-23	79166	2463	19	12554	154	61	2922	66	103	902	31
-22	75316	2305	20	12081	144	62	2834	65	104	880	31
-21	71677	2157	21	11628	134	63	2748	64	105	858	30
-20	68237	2019	22	11195	125	64	2666	63	106	837	30
-19	64991	1890	23	10780	116	65	2586	62	107	816	29
-18	61919	1770	24	10382	108	66	2509	60	108	796	29
-17	59011	1658	25	10000	100	67	2435	59	109	777	28
-16	56258	1553	26	9634	100	68	2364	58	110	758	28
-15	53650	1454	27	9284	100	69	2294	57	111	740	27
-14	51178	1363	28	8947	100	70	2228	56	112	722	27
-13	48835	1277	29	8624	99	71	2163	55	113	705	26
-12	46613	1197	30	8315	99	72	2100	54	114	688	26
-11	44506	1121	31	8018	98	73	2040	53	115	672	25
-10	42506	1051	32	7734	98	74	1981	52	116	656	25
-9	40600	985	33	7461	97	75	1925	52	117	640	24
-8	38791	923	34	7199	96	76	1870	51	118	625	24
-7	37073	865	35	6948	95	77	1817	50	119	611	23
-6	35442	810	36	6707	94	78	1766	49	120	596	23
-5	33892	759	37	6475	93	79	1716	48	121	583	23
-4	32420	712	38	6253	92	80	1669	47	122	569	22
-3	31020	667	39	6039	91	81	1622	46	123	556	22
-2	29689	625	40	5834	90	82	1578	46	124	544	22
-1	28423	586	41	5636	89	83	1535	45	125	531	21
0	27219	549	42	5445	88	84	1493	44			
1	26076	514	43	5262	87	85	1452	43			

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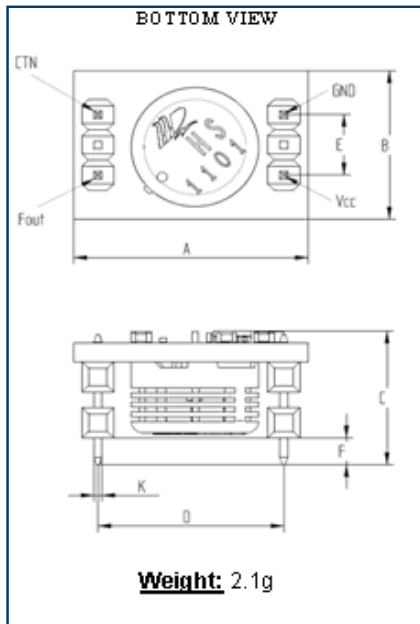
QUALIFICATION PROCESS

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

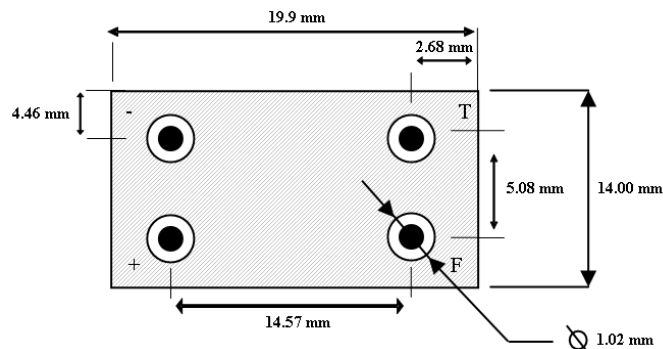
HTF3000LF PVH



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



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SOLDERING INFORMATION

HTF3000LF PVH: Hand soldering or wave soldering

ORDERING INFORMATION

HPP808H031 FOR HTF3000LF PVH

STORAGE: TUBE M.Q.P OF 48 PARTS; BOX M.Q.P OF 1008 PARTS (21 TUBES)

Customer Service contact details

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Revision	Comments	Who	Date
E	Mechanical dimension tolerances updated, Typical voltage supply changed into 5V (instead of 3.3V)	D. LE GALL	August 07
F	HTF3000LF RL reference added, product storage quantities added	D. LE GALL	November 07
G	Mechanical dimension tolerance updated	D. BEZ	December 07
H	Soldering information paragraph updated, chart2 improved (poor image), HTF3000LF SMD and HTF3000LF RL references removed	D. LE GALL	January 08
I	Standardized datasheet format	D. LE GALL	April 08

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