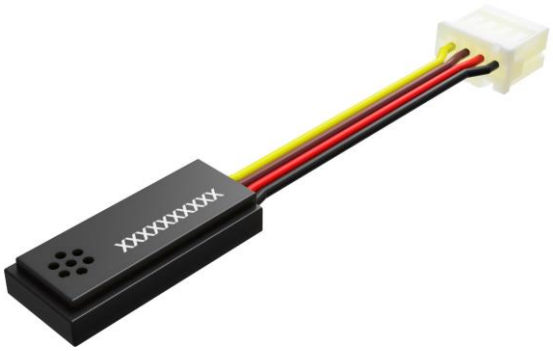


RHT1

Humidity and Temperature Module

RHT1 datasheet

Version: 2.0

Release Date: 2024-09-30

The RHT1 is an accurate and reliable temperature and humidity module. Thanks to its adaptable design, the RHT1 can be tailored to a multitude of applications.

Equipped with a state of the art temperature and relative humidity sensor, the RHT1 excels in accurate humidity and temperature detection at any given location. Ideal for consumer and industrial use, it offers plug-and-play integration for OEM applications. Not only the form factor and connector type, but also cable length and output signals can be adjusted on request.

Key features & benefits

Highest quality ensured through 100 % end of line testing

Unique serial number for traceability

Water immersion resistant and dust / grease protection thanks to a **PTFE membrane**

Flexibility: Adaptable in form factors, cable lengths, data outputs and connector types

Resolution: High resolution temperature (26 mV/°C) and humidity (26 mV/%RH) reading

Accuracy: Temperature accuracy (±0.3°C) and relative humidity accuracy (±3 %RH)

Versatility across a variety of applications: Adjustable and easy to position in application

Analogue Interface: Ease of integration and configuration, cost-effective, real-time output

Easy, plug-and-play implementation

Applications

Its adaptability makes the RTH1 module a very suitable solution across a spectrum of applications, including:

- Regulation of door heating in refrigerators to optimize energy consumption
- Fine-tuning humidity levels in air conditioners to ensure maximum efficiency and prevent mold formation
- Ensuring optimal toner adhesion and preventing paper curling in printers and copiers.

Properties

- Industrial proven package dimensions (W12 x L27 x H5.1 mm^3)
- Fully customizable in WxLxH, cable length and connector type, as well as output signals
- Temperature operating range from -40°C to 85°C
- Relative humidity operating range from 0% to 100% RH
- Calibrated, analog voltage output for temperature and humidity
- Supply voltage of 5 V

Content Guide

1 Pin assignment

The pin assignment of the RHT1 module is shown in Figure 1 and described in Table 1.

Figure 1: Pinout Description

Table 1: Pin description

Pin	Pin Name	Color	Pin Type	Description
1	GND	Black	Supply	Ground supply voltage
2	VDD	Red	Supply	Power voltage
3	VT	Brown	Output	Temperature output
4	VRH	Yellow	Output	Relative humidity output

2 Relative humidity and temperature specifications

Default conditions apply to values in Table 2, unless otherwise stated: 25 °C, 50 % RH, no MSL1 pre-conditioning, default periodic measurement.

Table 2: Temperature and humidity specifications

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
	Humidity					
H_{RANGE}	Relative humidity range		0		100	%RH
H_{ACC}	Relative humidity accuracy	T= 25°C; RH= 10% to 80%		±3		%RH
H_{REP}	Humidity repeatability	T= -40°C to 85°C		±0.1		%RH
H_{HYS}	Relative humidity hysteresis			±1		%RH
H_{RESP-S}	Relative humidity response sensitivity			26		mV/%RH
	Temperature					
T_{RANGE}	Temperature range		-40		85	°C
T_{ACC}	Temperature accuracy	T= -40°C to 85°C		±0.3		°C
T_{REP}	Temperature repeatability	T= -40°C to 85°C		±0.1		°C
T_{HYS}	Temperature hysteresis			±0.5		°C
T_{RESP-S}	Temperature response sensitivity			26		mV/°C

3 Electrical characteristics

Table 3 details the electrical characteristics of the RHT1. The min and max parameter values are guaranteed by production tests or SQC (Statistical Quality Control) methods.

Table 3: Electrical characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DD}	Positive supply		4.75	5	5.25	V
V_{RH}	Output voltage	%RH = 55%		2.47		V
V_T		T= 25°C		2.10		V
I_{DD}	Operating Current			3		mA

4 Absolute maximum ratings

Table 4: Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Units	Comments
Electrical Parameters					
V_{DD}	Supply Voltage	-0.30	6	V	
I_{SCR}	Input Current (latch-up immunity)	−50	+50	mA	
Electrostatic Discharge					
ESD_{HBM}	Electrostatic Discharge HBM	± 4000		V	JEDEC JS-001
ESD_{CDM}	Electrostatic Discharge CDM	± 750		V	JEDEC JS-002
Operating and Storage Conditions					
MSL	Moisture Sensitivity Level	1			Maximum floor lifetime is unlimited
T_{STRG}[1]	Storage Temperature	−40	+85	°C	
T_{AMB}	Operating Ambient Temperature	−40	+85	°C	
$T_{LIFETIME}$	Sensor lifetime	10		years	Under typical operating conditions

Stresses beyond those listed in Table 4 may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated under Table 3: Electrical characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability and lifetime.

[1] The RHT1 moisture sensitivity level is 1 (MSL1), which corresponds to an unlimited out-of-bag lifetime at T = 30°C; RH = 85 %RH maximum. The recommended storage conditions are 10 – 50 °C and 20 – 60 % relative humidity, preferably in the original sealed ESD bag.

5 Relative humidity and temperature output characteristics

The physical humidity and temperature measurements are translated into a ratiometric voltage output, proportional to the supply voltage. The humidity output ranges between 19.7 % and 73.7 % of the supply voltage, while the temperature output spans from 10 % to 90 % of the supply voltage. Before being converted into a voltage signal, the sensor module linearizes the physical values and compensates for both temperature and supply voltage variations. This method makes it possible to describe the relationship between the physical values (humidity resp. temperature) and the corresponding output voltage (V_{RH} resp. V_T) using a general linear equation.

5.1 Relative humidity look-up table

The humidity output can be described using the generic linear formula depicted in Equation 1, where V_{RH} is the output voltage of the module and V_{DD} the supply voltage. Equation 1 is graphically illustrated in Figure 1 and converted into a look-up table presented in Table 1, assuming $V_{DD} = 5\ \mathrm{V}$.

$$RH = -\frac{19.7}{0.54} + \frac{100}{0.54} \cdot \frac{V_{RH}}{V_{DD}}$$

Equation 1: Relative humidity conversion formula (result in %RH)

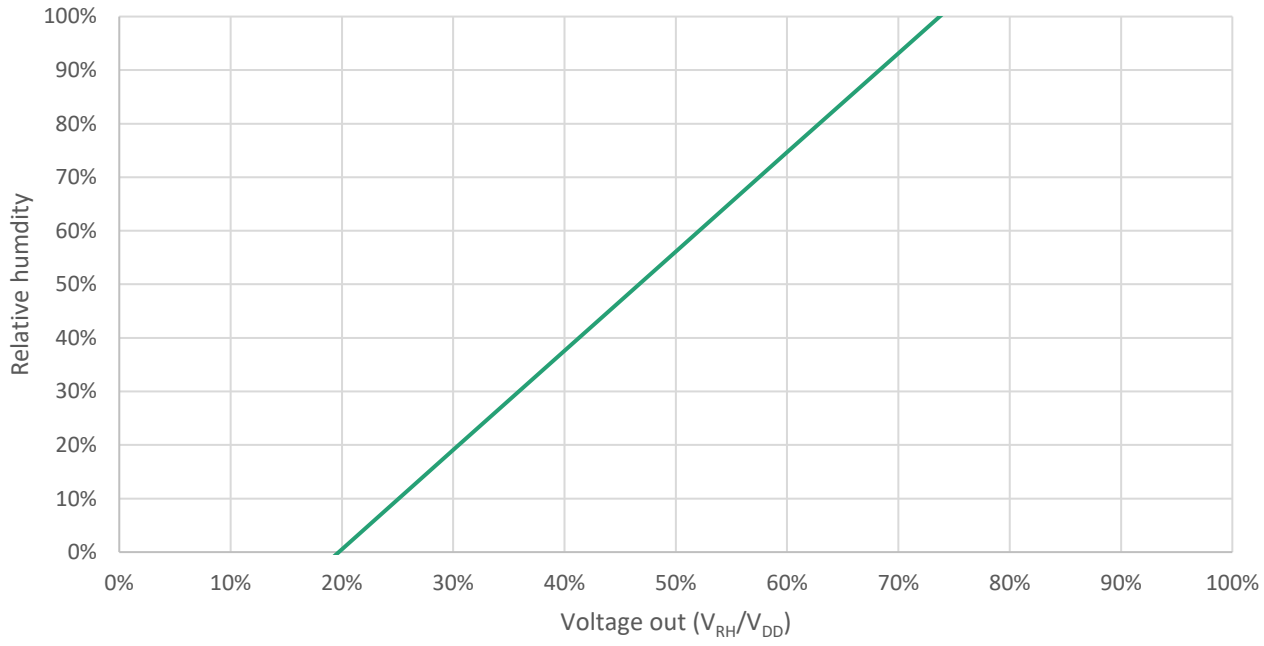


Figure 1: Relationship between the ratiometric analog voltage output and the measured relative humidity

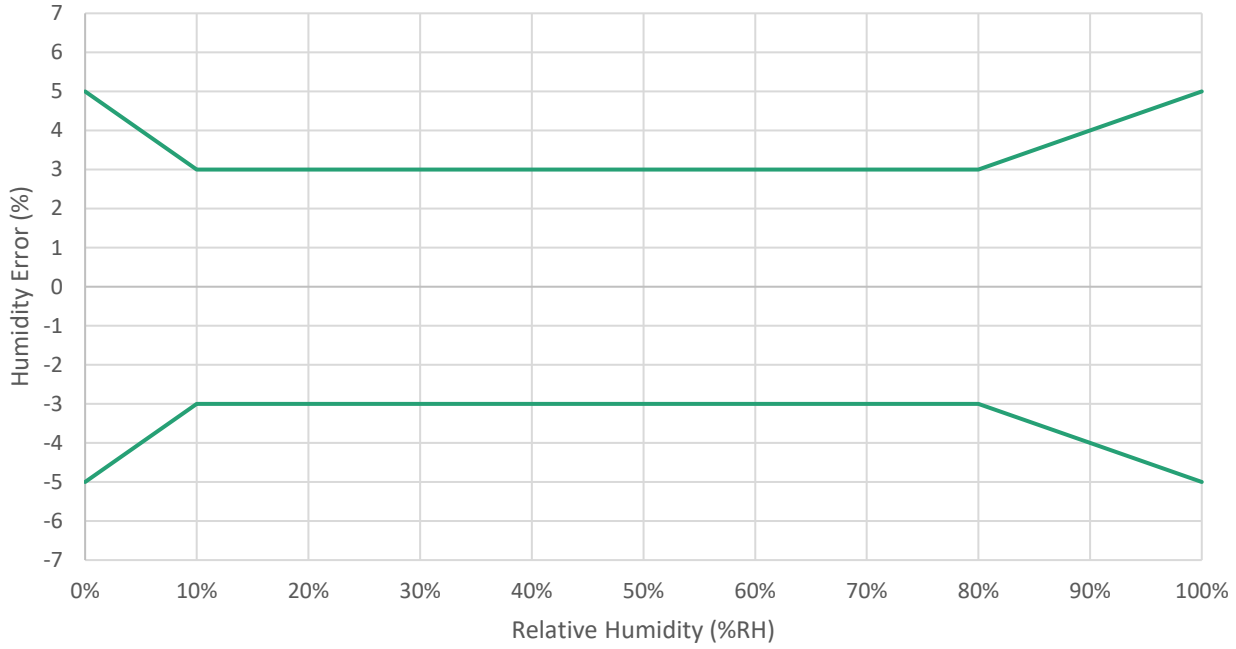
Table 6: Relative humidity sensor output lookup table (if V_{DD} = 5V)

RH (%)	V_{RH} (mV)	RH (%)	V_{RH} (mV)	RH (%)	V_{RH} (mV)	RH (%)	V_{RH} (mV)	RH (%)	V_{RH} (mV)
1	1012	21	1552	41	2092	61	2632	81	3172
2	1039	22	1579	42	2119	62	2659	82	3199
3	1066	23	1606	43	2146	63	2686	83	3226
4	1093	24	1633	44	2173	64	2713	84	3253
5	1120	25	1660	45	2200	65	2740	85	3280
6	1147	26	1687	46	2227	66	2767	86	3307
7	1174	27	1714	47	2254	67	2794	87	3334
8	1201	28	1741	48	2281	68	2821	88	3361
9	1228	29	1768	49	2308	69	2848	89	3388
10	1255	30	1795	50	2335	70	2875	90	3415
11	1282	31	1822	51	2362	71	2902	91	3442
12	1309	32	1849	52	2389	72	2929	92	3469
13	1336	33	1876	53	2416	73	2956	93	3496
14	1363	34	1903	54	2443	74	2983	94	3523
15	1390	35	1930	55	2470	75	3010	95	3550
16	1417	36	1957	56	2497	76	3037	96	3577
17	1444	37	1984	57	2524	77	3064	97	3604
18	1471	38	2011	58	2551	78	3091	98	3631
19	1498	39	2038	59	2578	79	3118	99	3658
20	1525	40	2065	60	2605	80	3145	100	3685

5.2 Relative Humidity Accuracy

The corresponding relative humidity accuracy is shown in the graph below.

Figure 4: Relative humidity accuracy



5.3 Temperature look-up table

The temperature output can be described using the generic linear formula depicted in Equation 2, where V_T is the output voltage of the module and V_{DD} the supply voltage. Equation 2 is converted into a look-up table presented in Table 5, assuming $V_{DD} = 5\,\mathrm{V}$.

$$T\,[°\mathrm{C}] = -66.875 + 218.75 \cdot \frac{V_T}{V_{DD}} = -45 - \frac{17.5}{0.8} + \frac{175}{0.8} \cdot \frac{V_T}{V_{DD}}$$

$$T\,[°\mathrm{F}] = -88.375 + 393.75 \cdot \frac{V_T}{V_{DD}} = -49 - \frac{31.5}{0.8} + \frac{315}{0.8} \cdot \frac{V_T}{V_{DD}}$$

Equation 2: Temperature conversion formula (result in °C and °F respectively)

Table 5: Temperature sensor output lookup table (if V_{DD} = 5V)

T (°C)	V_T (mV)	T (°C)	V_T (mV)	T (°C)	V_T (mV)	T (°C)	V_T (mV)	T (°C)	V_T (mV)
1	1551	21	2009	41	2466	61	2923	81	3380
2	1574	22	2031	42	2489	62	2946	82	3403
3	1597	23	2054	43	2511	63	2969	83	3426
4	1620	24	2077	44	2534	64	2991	84	3449
5	1643	25	2100	45	2557	65	3014	85	3471
6	1666	26	2123	46	2580	66	3037	86	3494
7	1689	27	2146	47	2603	67	3060	87	3517
8	1711	28	2169	48	2626	68	3083	88	3540
9	1734	29	2191	49	2649	69	3106	89	3563
10	1757	30	2214	50	2669	70	3129	90	3586
11	1780	31	2237	51	2694	71	3151	91	3609
12	1803	32	2260	52	2717	72	3174	92	3631
13	1826	33	2283	53	2740	73	3197	93	3654
14	1849	34	2306	54	2763	74	3220	94	3677
15	1871	35	2329	55	2786	75	3243	95	3700
16	1894	36	2351	56	2809	76	3266	96	3723
17	1917	37	2374	57	2831	77	3289	97	3746
18	1940	38	2397	58	2854	78	3311	98	3769
19	1963	39	2420	59	2877	79	3334	99	3791
20	1986	40	2443	60	2900	80	3357	100	3814

6 Package drawings & markings

Figure 5: RHT1 package drawing

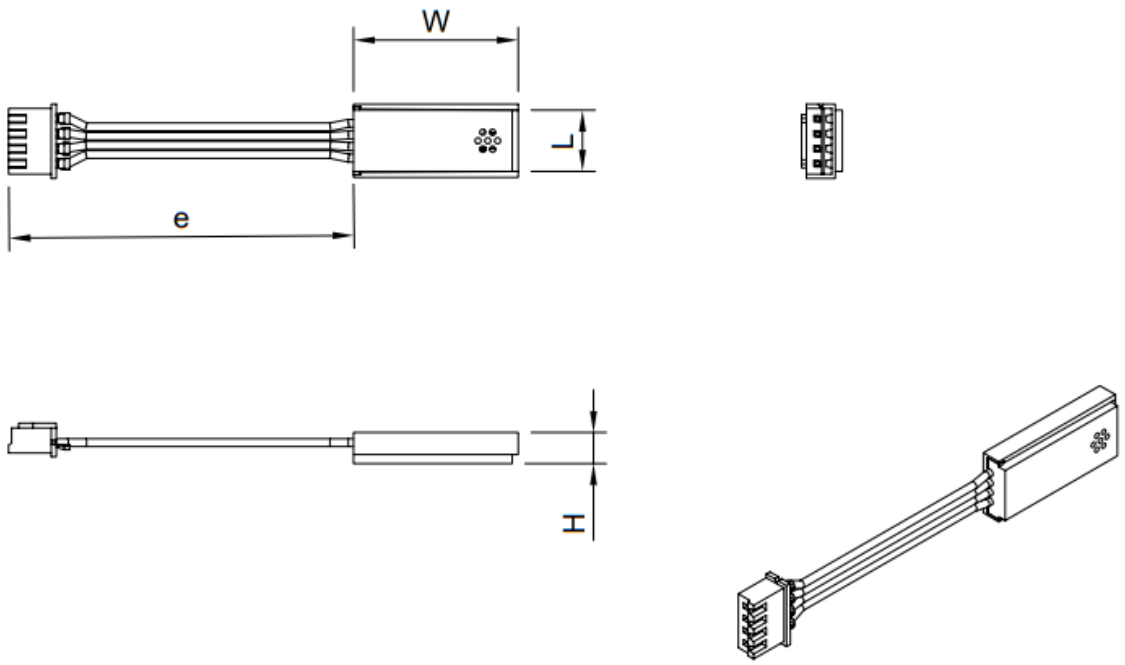


Table 6: Package dimensions in mm

Parameter	Symbol	Dimensions		
		Min	Nominal	Max
Body Size	W		27	
	L		12	
	H		5.1	
Cable Length	e	10	100	2000

Please note that the cable length is fully adaptable to the final application, and although there is no physical limit, we recommend staying within the range of 10 mm to 2000 mm. Moreover, the housing and connector can also be customized according to the final application and specific requirements.

Connector: TE-917688 (2.5 mm SIGNAL DBL-LOCK 4P PLUG HSG)

Mating part:

1. PCB Mount Header: TE-917724 (2.5 mm SIGNAL DBL-LOCK 4P POST HEADER ASS'Y)
2. Wire-to-Wire: TE-316088 (2.5 mm SIGNAL DBL LOCK 4P POST CAP HSG.)

7 Ordering information

Table 7: Ordering information

Ordering Code	Material ID	Delivery Form	Delivery Quantity
RHT1-F3535W100G26TE_AV	503701201		

8 RoHS Compliance & ScioSense Green Statement

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10 Revision information

Table 10: Revision history

Revision	Date	Comment	Pages
2.0	2024-09-30	Second version	All
0.9	2024-07-18	Initial version	All

Note(s) and/or Footnote(s):

1. Page and figure numbers for the previous version may differ from page and figure numbers in the current revision.
2. Correction of typographical errors is not explicitly mentioned.

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