HTW-211

HumiChip® Voltage Output Sensor Module

Features

- **Linear & Calibrated %RH Voltage Output.**
- **Rigid & Strong Molding Package**
- **Enhanced Inside Protection through Coated Materials**
- **Durability and Easy Installation**
- **Customized PTFE Filter and Temperature Output**

Product Summary

HTW-211 is an accurate and reliable humidity measuring sensor module based on **HumiChip®** .

The humidity output of the sensor is temperature compensated and is in linear voltage which can be directly interfaced with a microcomputer with an ADC input. The specially designed mold package and coating materials are ensuring durability and reliability even in harsh environment.

Electrical Specification

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	V_{cc}	4.75	5	5.25	V
Output Voltage Deviation(@Input Voltage)		-50	0	+50	mV
Humidity Average Sensitivity	ΔmV/RH		26.23		mV/%RH
Current Consumption[1)]	I_{cc}		0.75		mA

1) Typ. 25℃ 50%RH

Environmental

Parameter	Symbol	Value	Unit
Storage Temperature Range	T_{stg}	-55 ~ 125	℃
Operating Temperature Range	T_s	-40 ~ 85	℃
Operating Humidity Range	RH	0 ~ 100	%RH

Sensor Performance

RH% Characteristics

Humidity Characteristics	Symbol	Min.	Typ.	Max.	Unit
Output @50%RH & 5V(VCC)	H_V_{OUT}	2.274	2.350	2.428	V
Humidity Measuring Range [1)]	RH	0		100	%RH
Relative Humidity Accuracy [2)]		-3		+3	%RH
Humidity Hysteresis		-2		+2	%RH
Temperature Coefficient	T_{cc}		-0.05		%RH/℃
Response Time ($\tau_{63\%}$) [3)]			7.0		sec

1) Non condensation
2) Humidity range (30~80%RH)
3) Non PTFE Filter

Temperature Characteristics

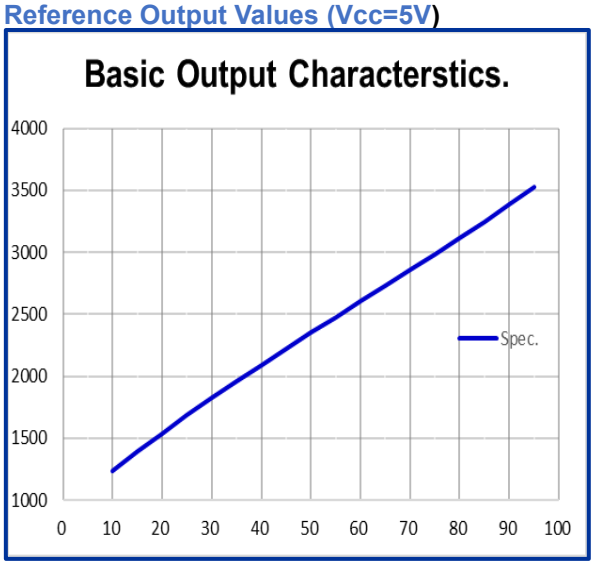
Temperature Characteristics		Symbol	Min.	Typ.	Max.	Unit
Temperature Measuring Range		T_a	-40		85	℃
Nominal Resistance @25℃		R	9.9	10.0	10.1	kΩ
Beat Value : B25/85		B	3346	3380	3414	K
Normal Resistance Tolerance @℃		T		1		%
B Value Tolerance		B		1		%
Response Time ($\tau_{63\%}$)	Thermistor unit [1]				<5	sec
	Module unit [2]				<115	sec

1) evaluates reaching time at 56.6℃ which is 63.2% of 25℃ → 75℃ (Resistance Value of 56.6℃ : 3.358 kΩ(Ref.)) -Non PTFE Filter

2) evaluates reaching time at 72.4℃ which is 63.2% of 25℃ → 75℃ (Resistance Value of 72.4℃ : 2.076 kΩ(Ref.)) -Non PTFE Filter

Humidity Look-up Table (@25℃)

Reference Output Values (Vcc=5V)



%RH	Vout(mV)	%RH	Vout(mV)
10	1235	55	2480
15	1390	60	2605
20	1540	65	2730
25	1685	70	2860
30	1825	75	2990
35	1960	80	3125
40	2090	85	3260
45	2220	90	3400
50	2350	95	3530

Polynomial Equations :

$$H\_V_{out}\,[mV] = 8.439 \times 10^{-4} \times RH^3 - 0.1485 \times RH^2 + 34.16 \times RH + 908.5$$

$$RH\,[\%] = -1.56 \times 10^{-9} \times H\_V_{out}{}^3 + 1.205 \times 10^{-5} \times H\_V_{out}{}^2 + 8.22 \times 10^{-3} \times H\_V_{out} - 15.6$$

Linear Equations :

$$H\_V_{out}\,[mV] = 26.23 \times RH + 1032$$

$$RH\,[\%] = 0.03812 \times H\_V_{out} - 39.36$$

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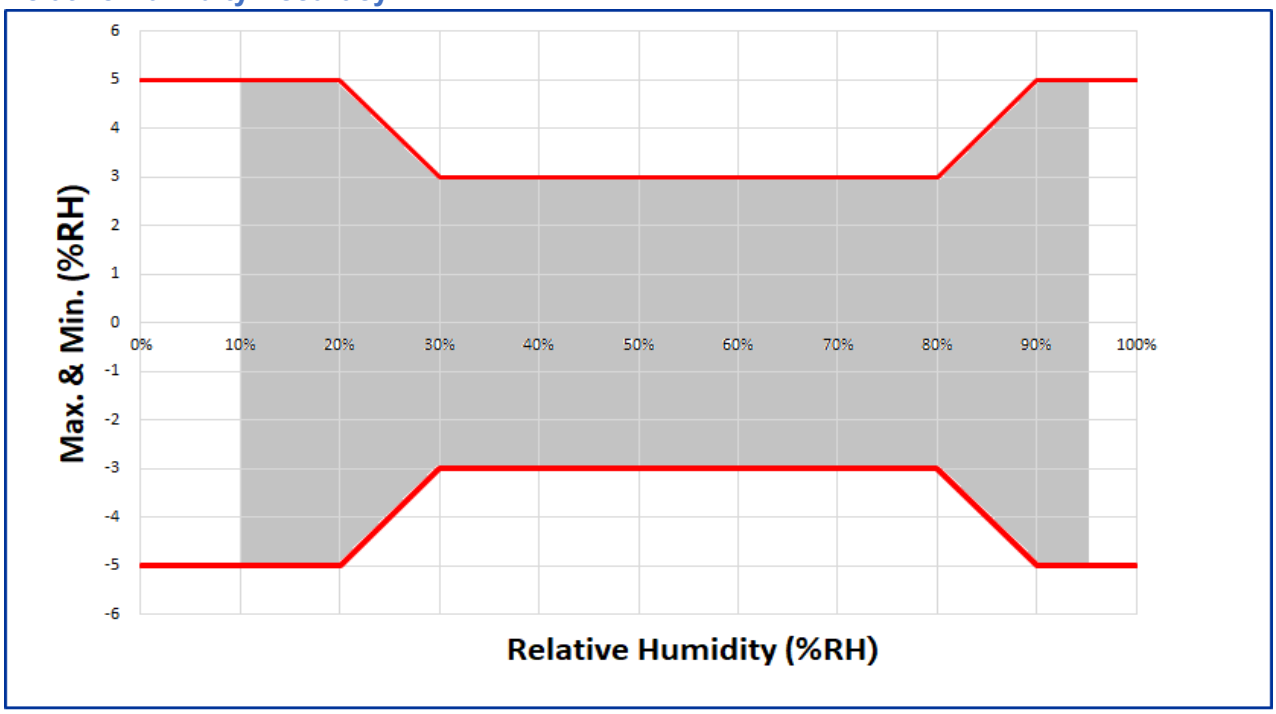
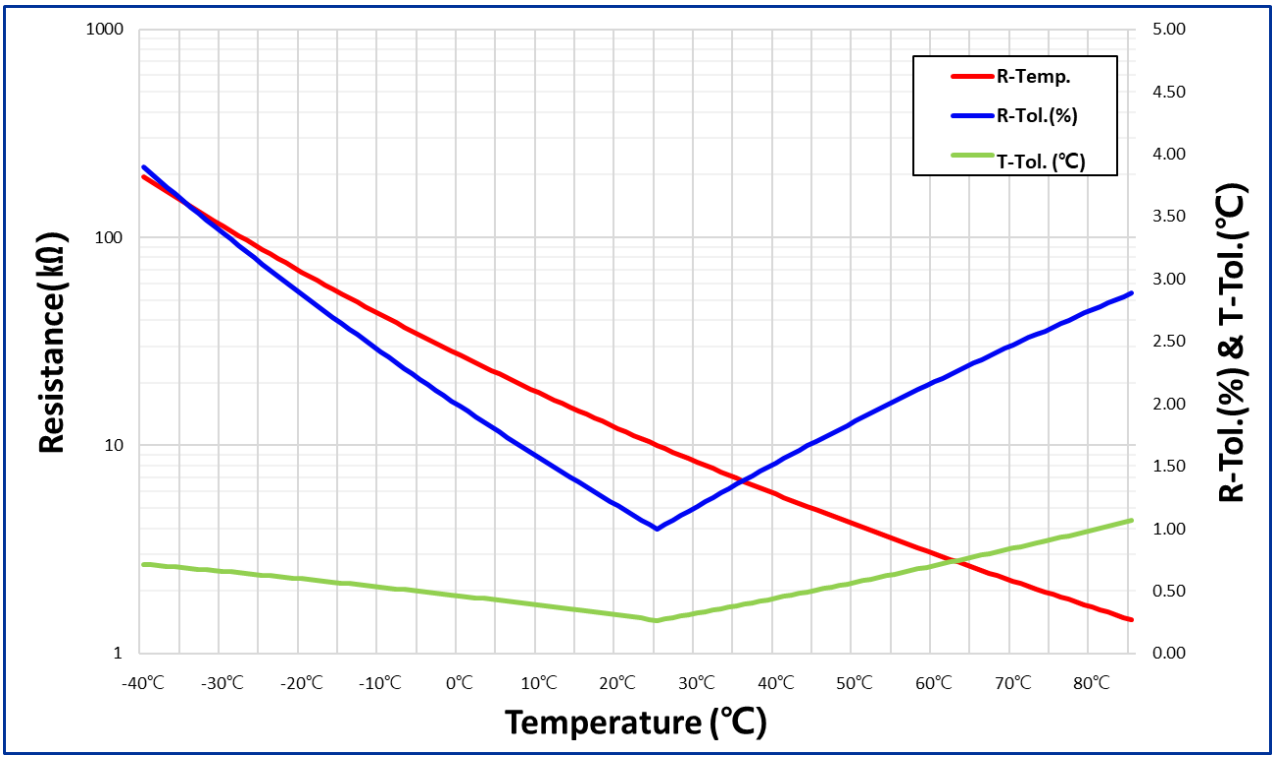
Relative Humidity Accuracy



HTW-211 sensor module is able to measure accuracy humidity optimized within 10 to 95%RH. The sensor accuracy is ±3%RH in 30%~80%RH range, and ±5%RH in less than 30%RH and over 80%RH range.

Temperature Look-up Table

R-T Characteristics & Tolerance



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TEMP.	RESISTANCE			RESIST.-TOL.		TEMP.-TOL.	
(℃)	(kΩ)			(%)		(℃)	
	MIN.	CENTER	MAX.	MAX.	MIN.	MAX.	MIN.
-40	188.0202	**195.652**	203.5731	3.89	3.90	0.71	0.72
-39	177.8044	**184.9171**	192.2951	3.84	3.85	0.69	0.73
-38	168.2141	**174.8452**	181.7195	3.78	3.79	0.66	0.74
-37	159.2069	**165.391**	171.7981	3.73	3.74	0.64	0.76
-36	150.7435	**156.5125**	162.486	3.68	3.69	0.62	0.77
-35	142.7877	**148.171**	153.7418	3.62	3.63	0.60	0.78
-34	135.3055	**140.3304**	145.5274	3.57	3.58	0.58	0.79
-33	128.2659	**132.9576**	137.8071	3.52	3.53	0.56	0.80
-32	121.6397	**126.0215**	130.5481	3.47	3.48	0.54	0.80
-31	115.4001	**119.4936**	123.7198	3.42	3.43	0.52	0.81
-30	109.5221	**113.3471**	117.294	3.36	3.37	0.50	0.82
-29	103.9894	**107.5649**	111.2522	3.31	3.32	0.49	0.82
-28	98.7725	**102.1155**	105.5611	3.26	3.27	0.47	0.82
-27	93.8512	**96.9776**	100.1981	3.21	3.22	0.46	0.82
-26	89.2071	**92.1315**	95.1423	3.16	3.17	0.44	0.83
-25	84.8227	**87.5588**	90.3741	3.12	3.12	0.43	0.83
-24	80.6819	**83.2424**	85.8755	3.07	3.08	0.42	0.83
-23	76.7698	**79.1663**	81.6295	3.02	3.03	0.41	0.83
-22	73.0722	**75.3157**	77.6204	2.97	2.98	0.40	0.82
-21	69.5761	**71.6768**	73.8336	2.92	2.93	0.39	0.82
-20	66.2694	**68.2367**	70.2554	2.87	2.88	0.38	0.82
-19	63.1477	**64.9907**	66.8807	2.83	2.84	0.37	0.81
-18	60.1923	**61.919**	63.6889	2.78	2.79	0.36	0.81
-17	57.3933	**59.0113**	60.6689	2.73	2.74	0.36	0.80
-16	54.7415	**56.2579**	57.8105	2.69	2.70	0.35	0.79
-15	52.2283	**53.6496**	55.104	2.64	2.65	0.35	0.79
-14	49.8456	**51.1779**	52.5406	2.59	2.60	0.34	0.78
-13	47.5859	**48.8349**	50.1117	2.55	2.56	0.34	0.77
-12	45.4422	**46.6132**	47.8097	2.50	2.51	0.33	0.76
-11	43.4078	**44.5058**	45.6271	2.46	2.47	0.33	0.75

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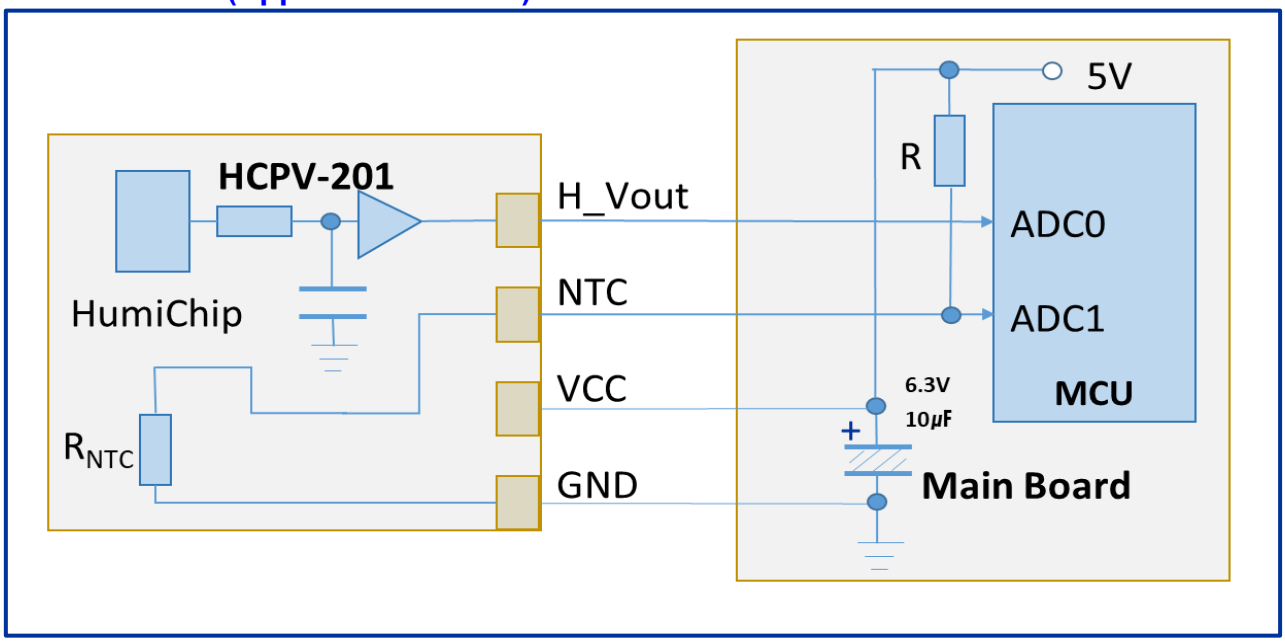
-10	41.4765	**42.5062**	43.557	2.41	2.42	0.32	0.74
-9	39.6345	**40.5997**	41.5843	2.37	2.38	0.32	0.74
-8	37.8855	**38.7905**	39.7131	2.32	2.33	0.31	0.73
-7	36.2244	**37.0729**	37.9374	2.28	2.29	0.30	0.72
-6	34.6461	**35.4417**	36.2519	2.23	2.24	0.29	0.71
-5	33.1462	**33.8922**	34.6515	2.19	2.20	0.29	0.71
-4	31.7202	**32.4197**	33.1313	2.15	2.16	0.28	0.70
-3	30.3641	**31.02**	31.6869	2.10	2.11	0.28	0.69
-2	29.074	**29.689**	30.314	2.06	2.07	0.27	0.68
-1	27.8465	**28.4231**	29.0088	2.02	2.03	0.27	0.67
0	26.678	**27.2186**	27.7675	1.98	1.99	0.27	0.66
1	25.569	**26.076**	26.5904	1.93	1.94	0.27	0.64
2	24.5123	**24.9877**	25.4698	1.89	1.90	0.27	0.63
3	23.5052	**23.9509**	24.4026	1.85	1.86	0.27	0.61
4	22.545	**22.9629**	23.3861	1.81	1.82	0.27	0.60
5	21.6294	**22.0211**	22.4175	1.77	1.78	0.27	0.58
6	20.756	**21.123**	21.4944	1.73	1.74	0.27	0.57
7	19.9227	**20.2666**	20.6143	1.69	1.70	0.27	0.55
8	19.1273	**19.4495**	19.7751	1.65	1.66	0.27	0.54
9	18.368	**18.6698**	18.9745	1.61	1.62	0.27	0.52
10	17.643	**17.9255**	18.2107	1.57	1.58	0.27	0.51
11	16.9494	**17.2139**	17.4807	1.53	1.54	0.27	0.49
12	16.287	**16.5344**	16.784	1.49	1.50	0.27	0.48
13	15.6541	**15.8856**	16.1189	1.45	1.46	0.26	0.46
14	15.0493	**15.2658**	15.4838	1.41	1.42	0.26	0.45
15	14.4712	**14.6735**	14.8772	1.37	1.38	0.26	0.43
16	13.9184	**14.1075**	14.2977	1.33	1.34	0.26	0.42
17	13.3898	**13.5664**	13.7439	1.29	1.30	0.26	0.40
18	12.8841	**13.0489**	13.2145	1.25	1.26	0.26	0.38
19	12.4002	**12.554**	12.7084	1.21	1.23	0.26	0.37
20	11.9371	**12.0805**	12.2244	1.18	1.19	0.26	0.35
21	11.4945	**11.6281**	11.7621	1.14	1.15	0.26	0.33
22	11.0703	**11.1947**	11.3195	1.10	1.11	0.27	0.32

23	10.6637	**10.7795**	10.8955	1.06	1.07	0.27	0.30
24	10.2738	**10.3815**	10.4892	1.03	1.04	0.27	0.28
25	9.9	**10**	10.1	0.99	1.00	0.26	0.27
26	9.5343	**9.6342**	9.7342	1.03	1.04	0.28	0.27
27	9.1838	**9.2835**	9.3833	1.06	1.07	0.30	0.28
28	8.8477	**8.947**	9.0465	1.10	1.11	0.32	0.29
29	8.5254	**8.6242**	8.7234	1.14	1.15	0.33	0.29
30	8.2162	**8.3145**	8.4132	1.17	1.18	0.35	0.30
31	7.9204	**8.0181**	8.1162	1.21	1.22	0.36	0.31
32	7.6367	**7.7337**	7.8312	1.25	1.25	0.38	0.32
33	7.3647	**7.4609**	7.5576	1.28	1.29	0.40	0.32
34	7.1038	**7.1991**	7.2951	1.32	1.32	0.41	0.33
35	6.8534	**6.9479**	7.043	1.35	1.36	0.43	0.34
36	6.6131	**6.7067**	6.8009	1.39	1.40	0.45	0.34
37	6.3825	**6.4751**	6.5683	1.42	1.43	0.46	0.35
38	6.1611	**6.2526**	6.3449	1.45	1.46	0.48	0.36
39	5.9485	**6.039**	6.1302	1.49	1.50	0.50	0.36
40	5.7443	**5.8336**	5.9238	1.52	1.53	0.52	0.37
41	5.5474	**5.6357**	5.7248	1.56	1.57	0.53	0.38
42	5.3582	**5.4454**	5.5333	1.59	1.60	0.54	0.39
43	5.1764	**5.2623**	5.3492	1.62	1.63	0.56	0.41
44	5.0015	**5.0863**	5.172	1.66	1.67	0.57	0.42
45	4.8333	**4.9169**	5.0015	1.69	1.70	0.58	0.43
46	4.6715	**4.7539**	4.8373	1.72	1.73	0.59	0.45
47	4.5159	**4.5971**	4.6793	1.76	1.77	0.60	0.46
48	4.3661	**4.4461**	4.5271	1.79	1.80	0.61	0.48
49	4.222	**4.3008**	4.3806	1.82	1.83	0.62	0.49
50	4.0833	**4.1609**	4.2395	1.85	1.86	0.63	0.51
51	3.9498	**4.0262**	4.1036	1.89	1.90	0.64	0.52
52	3.8213	**3.8964**	3.9727	1.92	1.93	0.65	0.54
53	3.6975	**3.7714**	3.8465	1.95	1.96	0.66	0.56
54	3.5783	**3.651**	3.7249	1.98	1.99	0.67	0.58
55	3.4634	**3.535**	3.6076	2.01	2.03	0.68	0.60

56	3.3527	**3.4231**	3.4946	2.05	2.06	0.68	0.62
57	3.2461	**3.3152**	3.3856	2.08	2.08	0.69	0.64
58	3.1432	**3.2113**	3.2804	2.11	2.12	0.69	0.66
59	3.0441	**3.111**	3.179	2.14	2.15	0.70	0.68
60	2.9486	**3.0143**	3.0812	2.17	2.18	0.70	0.71
61	2.8578	**2.9224**	2.9881	2.20	2.21	0.72	0.71
62	2.7703	**2.8337**	2.8984	2.23	2.24	0.74	0.72
63	2.6858	**2.7482**	2.8118	2.26	2.27	0.76	0.73
64	2.6044	**2.6657**	2.7282	2.29	2.30	0.78	0.74
65	2.5259	**2.5861**	2.6476	2.32	2.33	0.80	0.75
66	2.4501	**2.5093**	2.5697	2.35	2.36	0.82	0.75
67	2.377	**2.4351**	2.4945	2.38	2.39	0.84	0.76
68	2.3064	**2.3635**	2.4218	2.41	2.42	0.86	0.77
69	2.2382	**2.2943**	2.3517	2.44	2.45	0.88	0.78
70	2.1724	**2.2275**	2.2839	2.47	2.47	0.90	0.79
71	2.1086	**2.1627**	2.2181	2.50	2.50	0.92	0.80
72	2.0469	**2.1001**	2.1545	2.52	2.53	0.93	0.81
73	1.9873	**2.0396**	2.093	2.55	2.56	0.95	0.82
74	1.9298	**1.9811**	2.0335	2.58	2.59	0.97	0.83
75	1.8741	**1.9245**	1.9761	2.61	2.62	0.98	0.85
76	1.8204	**1.8698**	1.9205	2.64	2.64	1.00	0.86
77	1.7684	**1.817**	1.8667	2.66	2.67	1.01	0.87
78	1.7181	**1.7658**	1.8147	2.69	2.70	1.03	0.89
79	1.6695	**1.7164**	1.7644	2.72	2.73	1.05	0.90
80	1.6225	**1.6685**	1.7157	2.75	2.76	1.06	0.92
81	1.5772	**1.6224**	1.6687	2.77	2.79	1.08	0.93
82	1.5334	**1.5777**	1.6232	2.80	2.81	1.10	0.94
83	1.4909	**1.5345**	1.5792	2.83	2.84	1.12	0.95
84	1.4499	**1.4927**	1.5365	2.85	2.87	1.14	0.96
85	1.4101	**1.4521**	1.4952	2.88	2.89	1.15	0.97

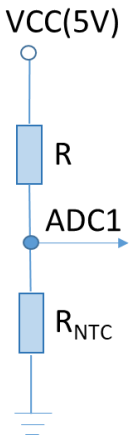
Basic Circuits (Application Circuit)



Temperature Calculator

$$Temp_{Cal.}(℃) = \frac{1}{8.61393E\text{-}04 + (2.56377E\text{-}04 \times \ln(R_{NTC})) + (1.68055E\text{-}07 \times (\ln(R_{NTC}))^3)} - 273.15$$

R=10 kΩ



$$ADC1(mV) = \frac{R_{NTC}}{R + R_{NTC}} \times VCC(mV)$$

Temp.(℃)	$Temp_{cal.}$	Dev.	R_{NTC}(kΩ)	ADC1(mV)
-40	-40.000	0.000	195.652	4757
-30	-29.846	-0.154	113.347	4595
-20	-19.781	-0.219	68.237	4361
-10	-9.793	-0.207	42.506	4048
0	0.195	-0.195	27.219	3657
10	10.117	-0.117	17.926	3210
20	20.042	-0.042	12.081	2736
25	25.000	0.000	10.000	2500
30	29.975	0.025	8.315	2270
40	39.924	0.076	5.834	1842
50	49.934	0.066	4.161	1469
60	60.002	-0.002	3.014	1158
70	69.932	0.068	2.228	911
80	79.913	0.087	1.669	715
85	84.906	0.094	1.452	634

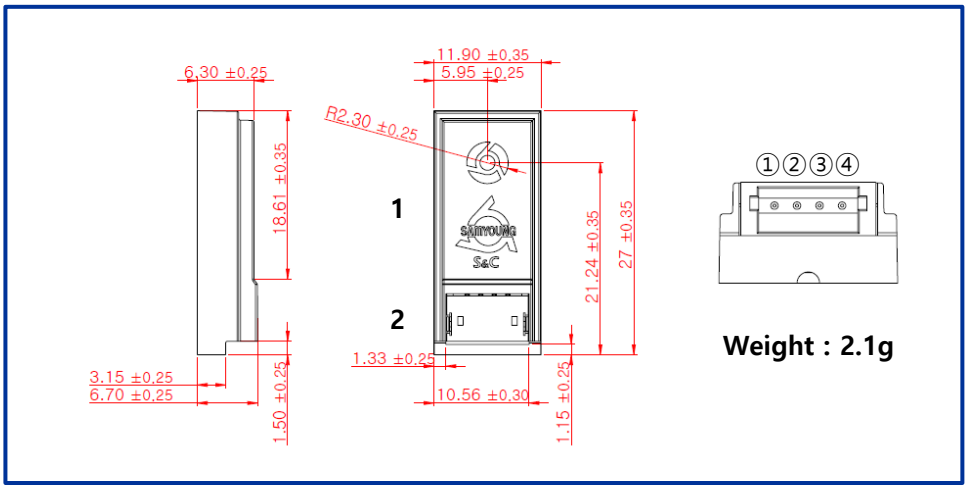
Reliability

No.	Test Item	Test Condition	Test Criterion
1	High Temperature Storage Life	After Stressing 500 hours at 90℃, and after leaving for 24 hours at the normal temperature, and confirm the operation.	Deviation < ±5%RH
2	Low Temperature Storage Life	After Stressing 500 hours at -30℃, and after leaving for 24 hours at the normal temperature, and confirm the operation.	Deviation < ±5%RH
3	Temperature & Humidity Storage	After Stressing 500 hours at 85℃, 85%RH, with bias applied to the device, and after leaving for 24 hours at the normal temperature, and confirm the operation.	Deviation < ±5%RH
4	Thermal shock	A cycle is exposed to -40℃, 100℃ with 30minutes period time, undergo 500 cycles, (Transition time : max 10 sec.) and after leaving for 24 hours at the normal temperature, and confirm the operation.	Deviation < ±5%RH

Dimensions

Parts Dimensions

Unit : mm



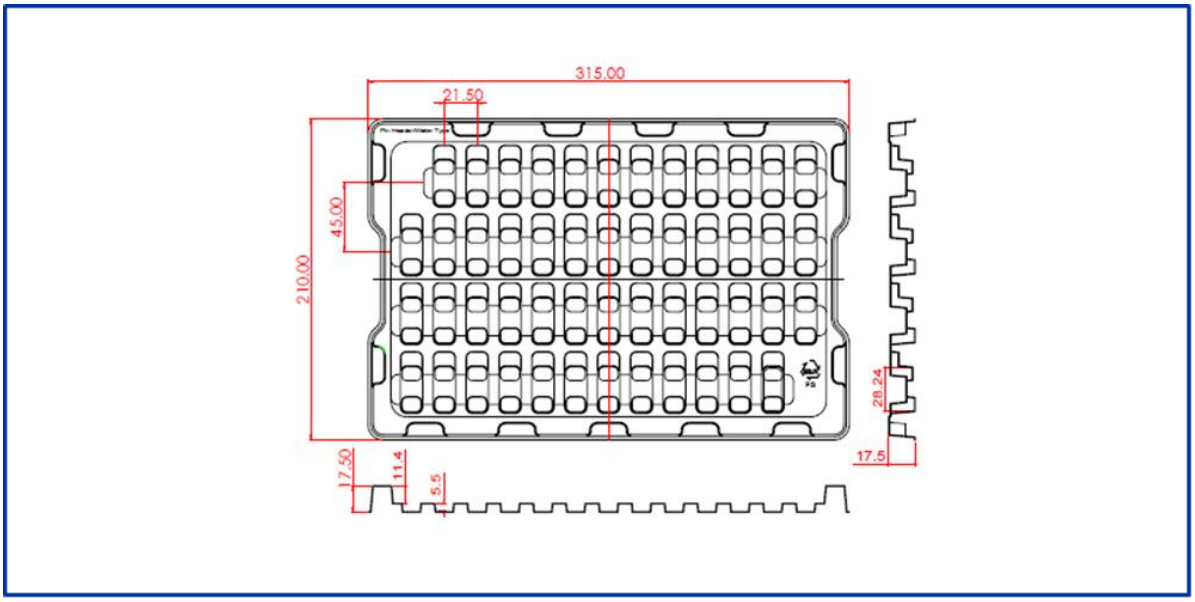
NO.	Component parts	Spec.	Qty.	Color	Maker	Remark
1	Case	PC (Polycarbonate)	1	BLACK		
	PCB	FR4	1			
	Sensor	HumiChip	1		SAMYOUNG S&C	
2	Wafer	15001WR-04	1	WHITE	YEONHO	①GND ②VCC ③NTC ④H_Vout

Packaging

Type	Quantity(pcs.)		Size (W × L × H ㎜)	
	Tray	Out box	Tray	Out box
HTW-211	50	800 (50×16)	315×210×17.5	350×250×220

Tray

50 pcs / 1Tray (PS, 315×210×17.5 ㎜)



Box

Out box