

## Electrical Specification

# HCPV-201W-1X series

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

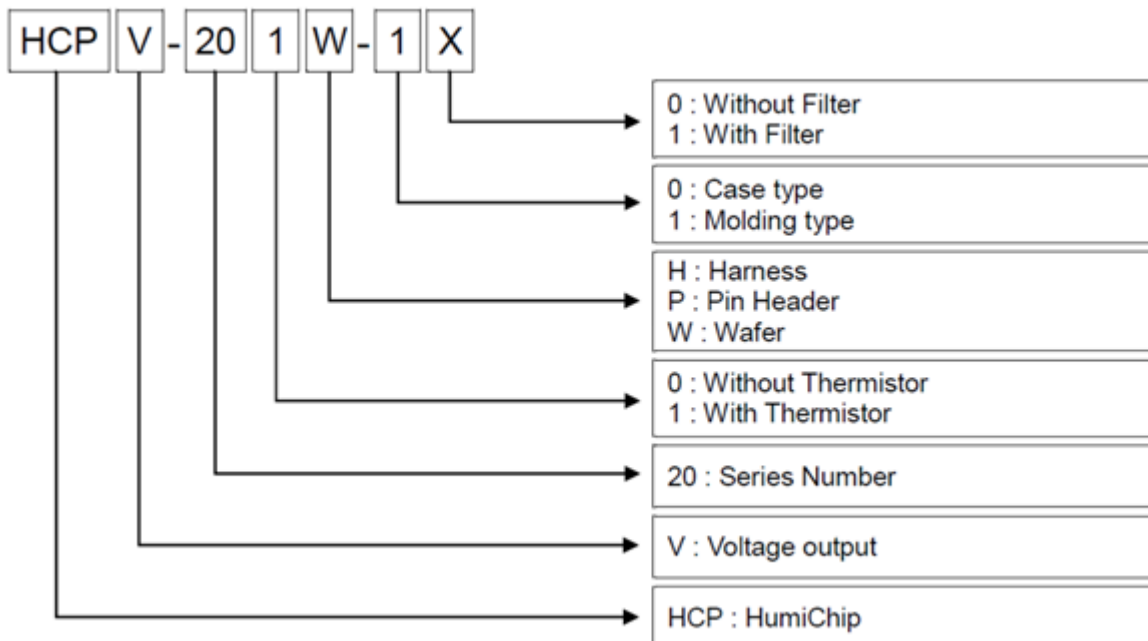


## Product Summary

HCPV-201W-1X 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.

## Part Number



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## Electrical Specification

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	V <sub>CC</sub>	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 <sup>1)</sup>	I <sub>CC</sub>		0.75		mA

1) Typ. 25°C 50%RH R=10 kΩ

## Environmental

Parameter	Symbol	Value	Unit
Storage Temperature Range	T <sub>stg</sub>	-55 ~ 125	°C
Operating Temperature Range	T <sub>s</sub>	-40 ~ 85	°C
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 <sub>OUT</sub>	2.274	2.350	2.428	V
Humidity Measuring Range <sup>1)</sup>	RH	0		100	%RH
Relative Humidity Accuracy <sup>2)</sup>		-3		+3	%RH
Humidity Hysteresis		-2		+2	%RH
Temperature Coefficient	T <sub>CC</sub>		-0.05		%RH/°C
Response Time (τ <sub>63%</sub> ) <sup>3)</sup>			7.0		sec

1) Non condensation

2) Humidity range (20~80%RH)

3) Non PTFE Filter

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## Temperature Characteristics

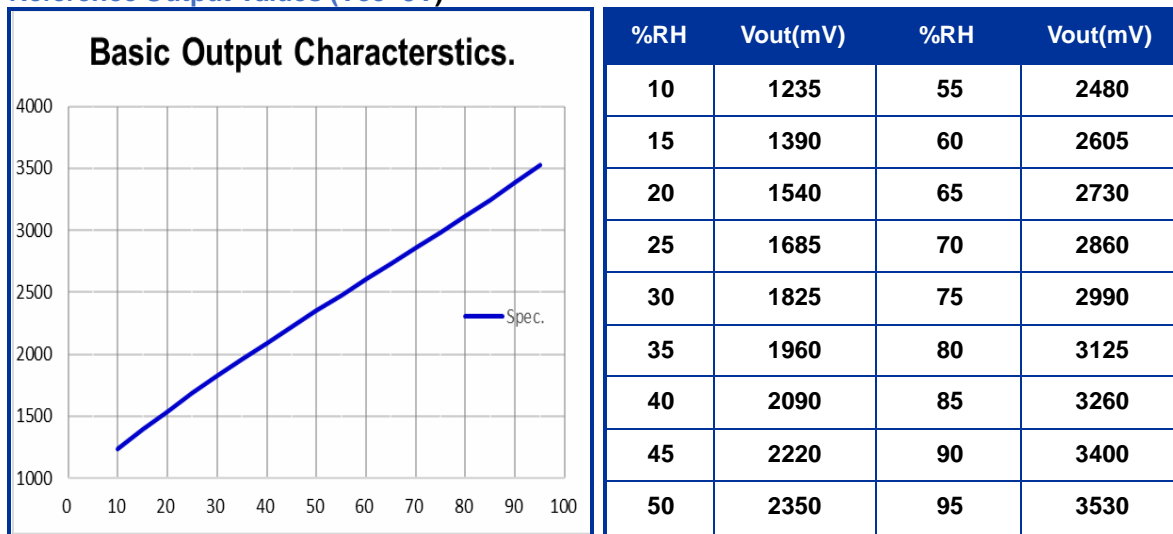
Temperature Characteristics		Symbol	Min.	Typ.	Max.	Unit
Temperature Measuring Range		T <sub>a</sub>	-40		85	°C
Nominal Resistance @25°C		R	9.9	10.0	10.1	kΩ
Beat Value : B25/85		B	3346	3380	3414	K
Normal Resistance Tolerance @°C		T		1		%
B Value Tolerance		B		1		%
Response Time (τ <sub>63%</sub> )	Thermistor unit <sup>1)</sup>				<5	sec
	Module unit <sup>2)</sup>				<115	sec

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

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

## Humidity Look-up Table (@25°C)

### Reference Output Values (V<sub>cc</sub>=5V)



## Polynomial Equations :

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

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

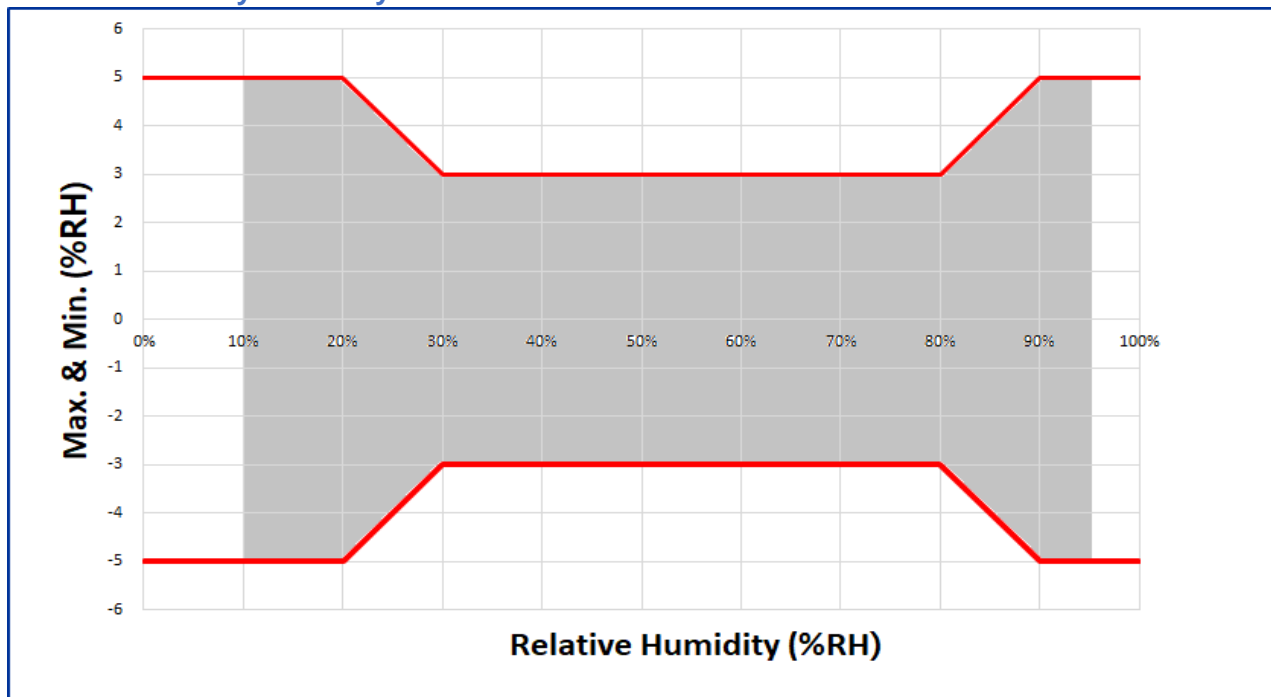
## Linear Equations :

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

$$RH [%] = 0.03812 \times V_{out} - 39.36$$

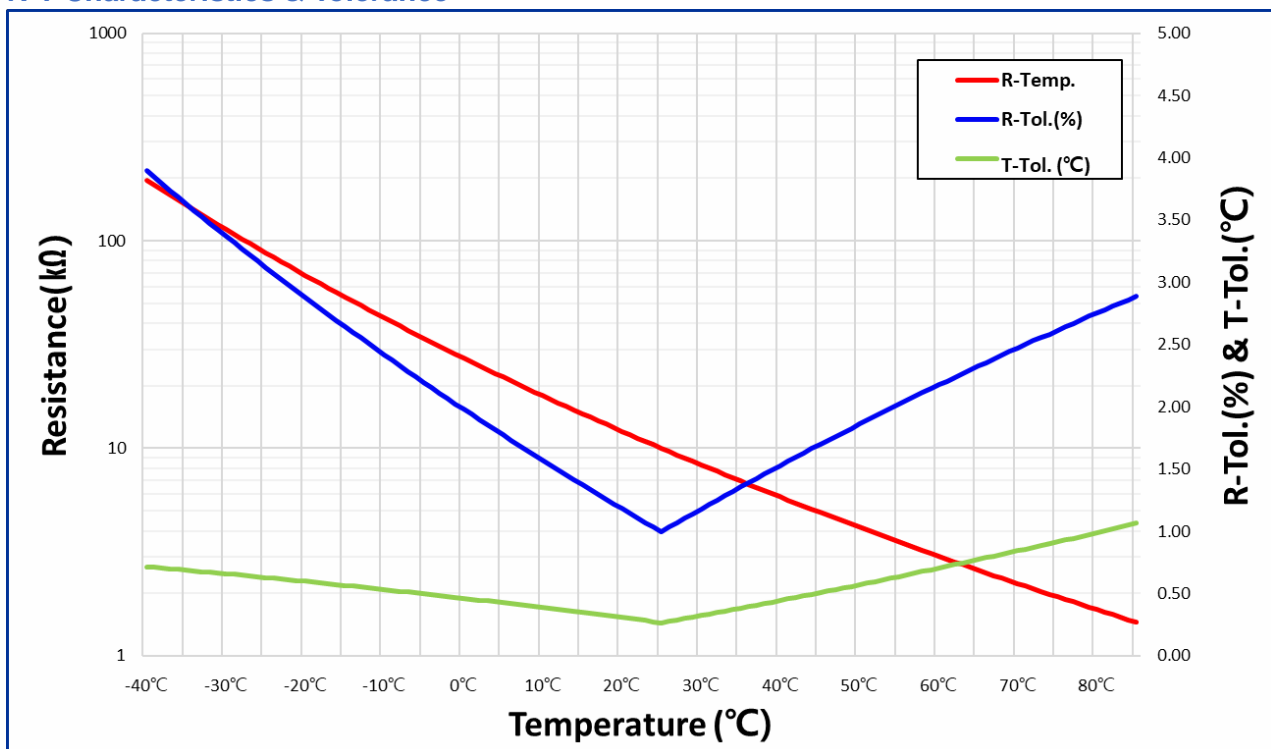
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## Relative Humidity Accuracy



HCPV-201W-1X series sensor module is able to measure accuracy humidity optimized within 10 to 95%RH. The sensor accuracy is  $\pm 3\%RH$  in 30%~80%RH range, and  $\pm 5\%RH$  in less than 30%RH and over 80%RH range.

## Temperature Look-up Table R-T Characteristics & Tolerance



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

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

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## Electrical Specification

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Output Voltage Deviation(@Input Voltage)		-50	0	+50	mV
Humidity Average Sensitivity	$\Delta mV/RH$		26.23		mV/%RH
Current Consumption <sup>1)</sup>	$I_{CC}$		0.75		mA

1) Typ. 25°C 50%RH R=10 kΩ

## Environmental

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

## Sensor Performance

### RH% Characteristics

Humidity Characteristics	Symbol	Min.	Typ.	Max.	Unit
Output @50%RH & 5V(VCC)	$H_{VOUT}$	2.274	2.350	2.428	V
Humidity Measuring Range <sup>1)</sup>	RH	0		100	%RH
Relative Humidity Accuracy <sup>2)</sup>		-3		+3	%RH
Humidity Hysteresis		-2		+2	%RH
Temperature Coefficient	$T_{CC}$		-0.05		%RH/°C
Response Time ( $\tau_{63\%}$ ) <sup>3)</sup>			7.0		sec

1) Non condensation

2) Humidity range (20~80%RH)

3) Non PTFE Filter

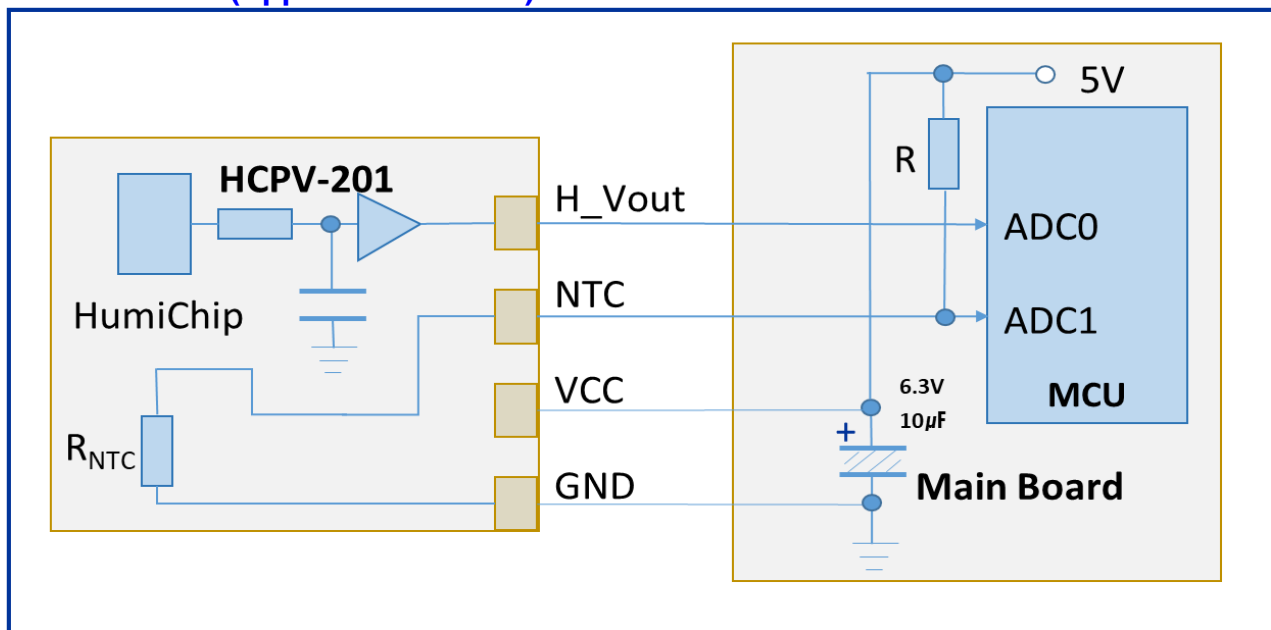
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56	3.3527	<b>3.4231</b>	3.4946	2.05	2.06	0.68	0.62
57	3.2461	<b>3.3152</b>	3.3856	2.08	2.08	0.69	0.64
58	3.1432	<b>3.2113</b>	3.2804	2.11	2.12	0.69	0.66
59	3.0441	<b>3.111</b>	3.179	2.14	2.15	0.70	0.68
60	2.9486	<b>3.0143</b>	3.0812	2.17	2.18	0.70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

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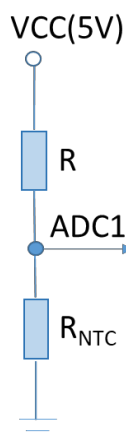
## Basic Circuits (Application Circuit)



## Temperature Calculator

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

R=10 kΩ



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

Temp.(°C)	Temp.cal.	Dev.	R <sub>NTC</sub> (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

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## Reliability

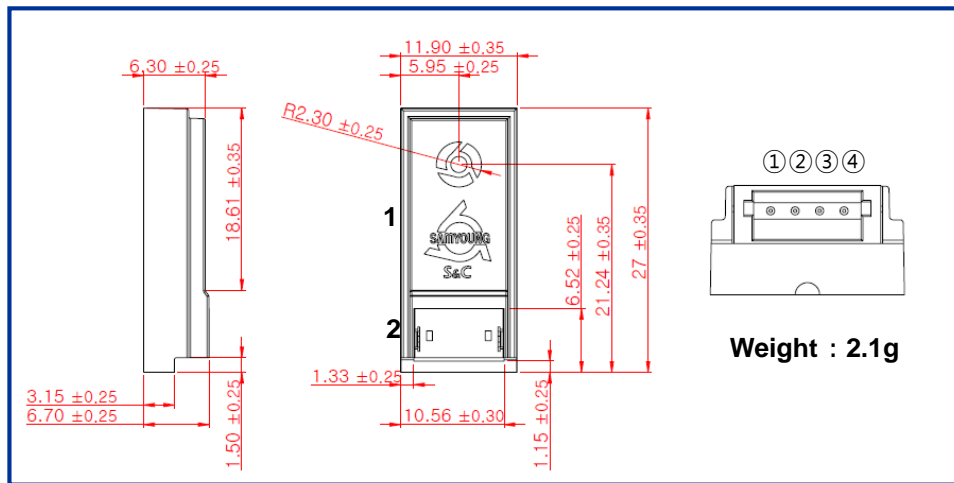
No.	Test Item	Test Condition	Test Criterion
1	High Temperature Storage Life	After Stressing 500 hours at 90°C, and after leaving for 24 hours at the normal temperature, and confirm the operation.	Deviation < ±5%RH
2	Low Temperature Storage Life	After Stressing 500 hours at -30°C, and after leaving for 24 hours at the normal temperature, and confirm the operation.	Deviation < ±5%RH
3	Temperature & Humidity Storage	After Stressing 500 hours at 85°C, 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°C, 100°C 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

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## 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

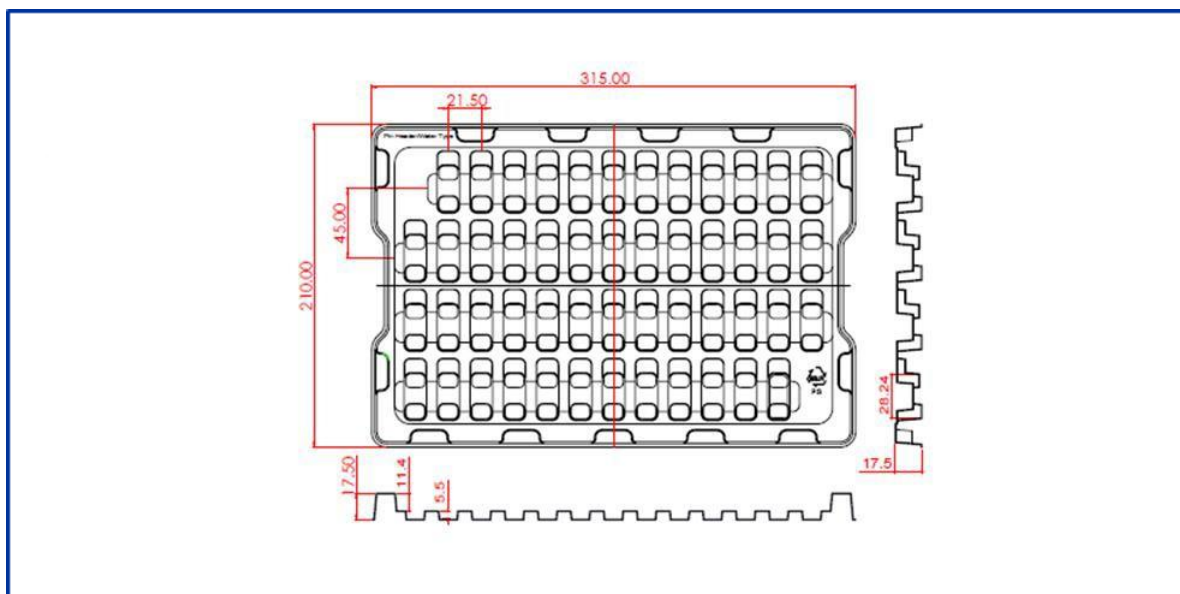
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## Packaging

	Tray	Out box	Tray	Out box
	50	800 (50×16)	315×210×17.5	350×260×230

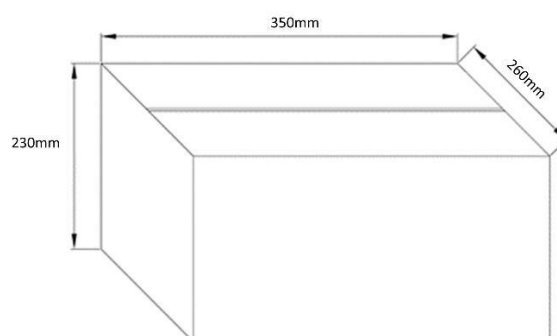
## Tray

50 pcs / 1Tray (PS, 315×210×17.5 mm)



## Box

### Out box



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## Revision History

Date	Version	Page(s)	Changes
Mar. 09	0.7		First Release

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