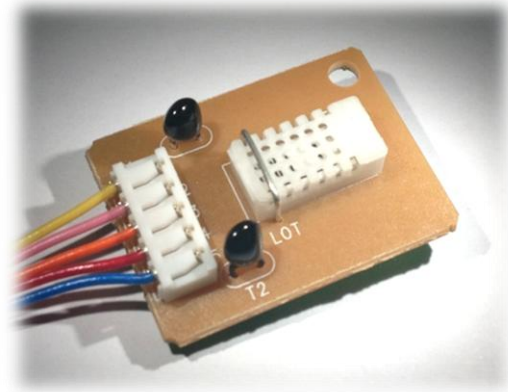


SY-HS-25NT

Humidity Sensor Module.

Features

- ♦ High Reliability & Excellent Life span
- ♦ Outstanding Durability
- ♦ Wide Operating Temp. Range
- ♦ Interchangeability
- ♦ Availability of Customized products



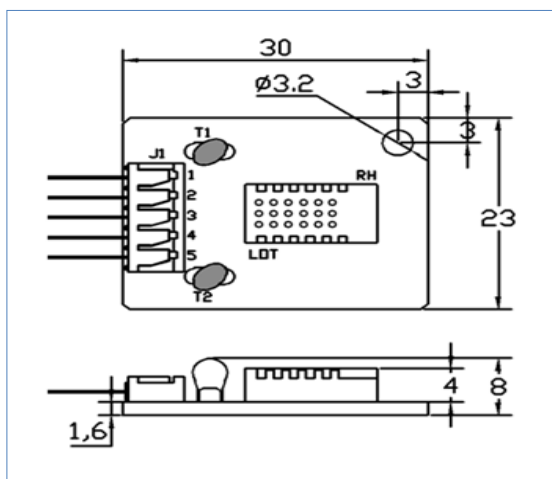
Description

A resistive humidity sensor, SY-HS-25 Series, is composed of excellent durable resistive sensor and a thermistor for temperature compensation and offers cost competitiveness and convenience for humidity measurement.

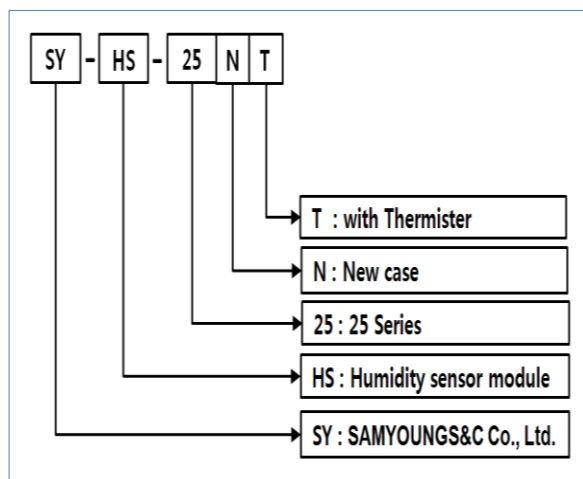
This module uses specially consolidated polymer and is designed for industrial environment that includes both temperature environment (-20~85°C) and humidity environment with dew condensation and gases. In addition, it can be used without calibration so that replacement of sensor is easy and convenient.

SY-HS-25 Series have been adopted by worldwide enterprises and applied to various applications like home appliances (such as air-conditioning, refrigerator, humidifier, and dehumidifier), HVAC, weather station, food processing, and office equipment (such as printers, copy machines).

Dimension



Part Number



Electrical Specification

Parameter	Value
Rated Voltage	AC 5V _{peak} (1V _{RMS} recommended)
Rated Power	0.26mW (at 5V _{peak})

Environmental

Parameter	Symbol	Value	Unit
Operating Temperature Range	T _s	-20~85	°C
Operating Humidity Range	RH	20~90	%RH
Storage Temperature Range	T _{stg}	-30~85	°C
Storage Humidity Range		Less than 95%RH	%RH

Sensor Performance

Relative Humidity (RH%)

Humidity Characteristics	Symbol	Min.	Typ.	Max.	Unit
Standard Characteristic (at 25°C, 60%RH, 1Vrms, 1 kHz)			33		KΩ
Operating Frequency Range		0.1		10	kHz
Relative Humidity Accuracy (at 25°C, 60%RH)			±3		%RH
Humidity Hysteresis (at 25°C, 40⇔80%RH)			±2		%RH
Response Time (40⇔80%RH))		60			sec.
Temperature Coefficient	T _{cc}		0.5		%RH/°C

Temperature (°C)

Temperature Characteristics	Symbol	Min.	Typ.	Max.	Unit
Temperature Measuring Range	T _a	-40		120	°C
Nominal Resistance @25°C	R	47.5	50	52.5	KΩ
Beat Value : B25/85	B		4500		K
Normal Resistance Tolerance @°C	T		±5		%
B Value Tolerance	B		±3		%

Reliability

No	Test Item	Test Condition	Test Criterion
1	High temperature/high humidity loading	- Temperature : 85 °C, Humidity : 85 %RH Test time : 1000 hours, Bias : 5V _{peak} , 1kHz Recovery time : 12 hours	< ± 5%RH
2	Low temperature storage	- Temperature : - 45°C, Test time : 1,000 hours. Recovery time : 12 hours	< ± 5%RH
3	High temperature loading	- Temperature: 85°C, Test time : 1,000 hours Bias : 5V _{peak} , 1kHz, Recovery time : 12 hours	< ± 5%RH
4	Temperature cycle	- Temperature : -45(30min)↔85(30min)°C Cycle : 100 times (1 times = 5 hrs) Recovery time : 12 hours	< ± 5%RH
5	Humidity / Temperature cycle	- Temperature : -45(60min)↔85(60min)°C Humidity : 45(60min)↔85(60min)%RH Cycle : 100 times (1 times = 5 hrs) Recovery time : 12 hours	< ± 5%RH
6	Water resistance	- Soaking water (sensor only) Test time : 3~15 min., Recovery time : 12 hours	< ± 5%RH
7	Voltage resistance	- Impress 5V _{peak} , 1kHz, Test time : 2,000 hours. Recovery time : 1 ~ 2 hours	< ± 5%RH
8	Organic solvent resistance	- Benzene 30wt.%+Xylene 40wt.% +Toluene 30wt.%. Temperature: 25°C, Test time : 300 hours, Recovery time : 12 hours (Except sensor case (ABS resin))	< ± 5%RH

Mechanical Characteristics

1. Shock Resistance

Not to be abnormal in the appearance and electrical characteristics after having been naturally let to drop down 3 times at random onto a hard wooden plate from the height of 100cm.

2. Vibration Resistance

Not to be abnormal in the appearance and electrical characteristics after having been vibration-tested for 2 hours each in the directions of X-Y-Z, at the frequency of 10~55, and amplitude of 1.5mm (10-55-10).

3. Resistance to Soldering Heat

Not to be abnormal in the appearance and electrical characteristics after lead terminal shall be immersed down by 3mm from the substrate for 10 seconds in a solder bath of $280 \pm 5^\circ\text{C}$.

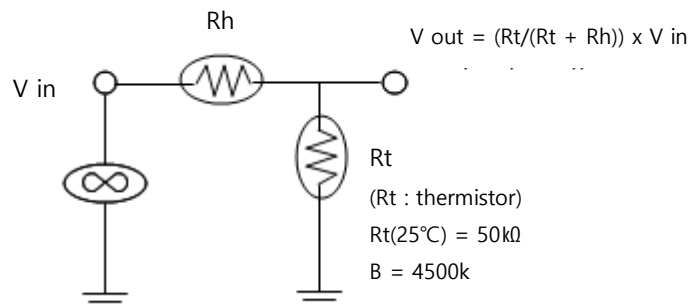
4. Strength of Terminations (Tensile)

Lead terminal shall be secured by the body after it shall be pulled with the specified force of 500g for 10 seconds in the axial direction of lead terminal.

Measuring Systems (Sensor)

LCR meter	HIOKI 3532-50	Hygrometer	Dew Master Edgetech,.
Chamber	ESPEC PDR-3KP (Accuracy : $\pm 2.5\%RH$)		

Circuit Configuration



$$\text{Output voltage } V_o = k \times V_i[V]$$

$$\text{Here, } k = \text{resistance ratio} = \frac{R_t}{(R_t + R_h)}$$

(V_i = rated voltage [V], R_t = thermistor resistance [$\text{k}\Omega$], R_h = humidity sensor resistance [$\text{k}\Omega$])

Application Note

1. DC Voltage

If DC voltage is applied to the humidity sensor, **the migration phenomenon** will be occurred in the sensor. The migration effect become resistance quality defective and cause of short circuit (polarization phenomenon)

2. Water Condensing

If the water (water-drop, moisture.. etc) is **condensed on the humidity sensor surface** (over 6hrs), the sensor (humidity sensitive) membrane will be melt in the water. It become resistance quality defective.

3. Drenching (Water, solvent, etc.)

If the humidity sensor is **soaked in the liquid material** (water, solvent, etc)(over 30 min), the sensor (humidity sensitive) membrane will be melt in the water. It become resistance quality defective.

4. Ionic Atmosphere

SYH series humidity sensor is made by using ionic polymer membrane. Therefore if the humidity sensor is exposed **ionic atmosphere** (salty air, anionic ionizer.. etc) for a long time, **the resistance-drop characteristics** will occur in the sensor

5. Organic / Inorganic Gas

If the humidity sensor is exposed **organic / inorganic gases** for a long time that have reactive polymer membrane, the sensor (humidity sensitive) membrane will be damaged. It become resistance quality defective. (For example : SO_x, NO_x, Ammonia, Alcohol, Glycol .. etc.)

6. Breakdown / Scratch / Membrane touching

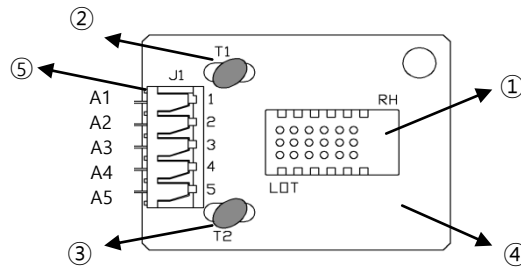
If the humidity sensor is received physical external pressure such as **breakdown of sensor substrate, sensor scratch, touching sensor membrane**, the sensor (humidity sensitive) membrane and electrode will be damaged. It become resistance quality defective.

7. Heating Stress (Thermal Shock)

In relation to **heating stress**, take extra caution using in the atmosphere of the below

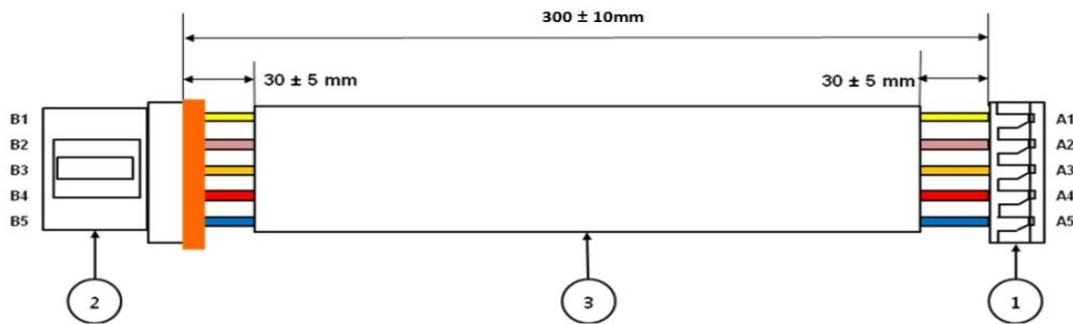
- 1) Using the humidity sensor at over-range temperature
- 2) Failed circuit design
- 3) PCB soldering process

Fig. 1. Standard Dimension and Material



Parts

No.	Name	Spec.	Maker.	Remark.	PIN Out Assignment		
					No.	Pin	Function
1	Humidity sensor	SYH-2R	SAMYOUNG S&C		1	A1	Vcc
2	Thermistor (T1)	NTC-50KD-5J	Samkyung ceramic	β -value = 4500K	2	A2	Temp-AD
3	Thermistor (T2)	NTC-50KD-5J	Samkyung ceramic	β -value = 4500K	3	A3	Humi-PWM1
4	PCB	30x23x1.6mm		Phenol PCB	4	A4	Humi-AD
5	HOUSING	YBH250-05	YEONHO		5	A5	Humi-PWM2



Part List [BOM]

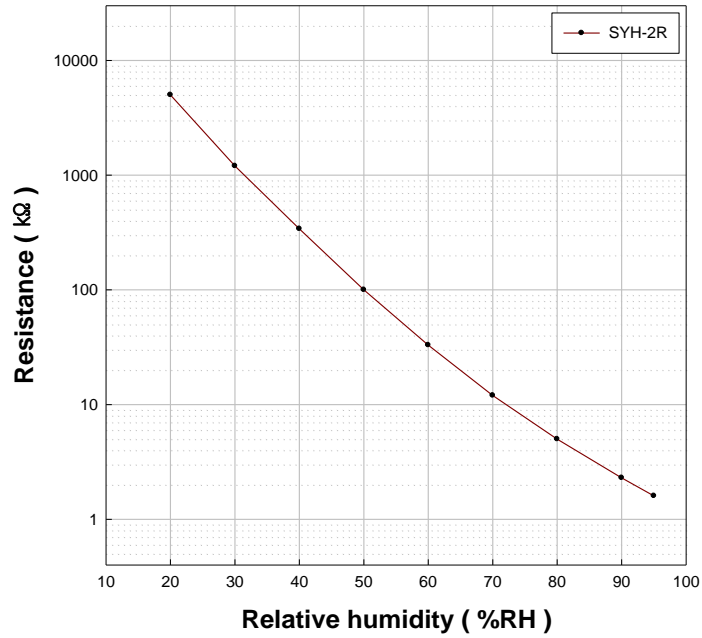
No.	Name.	Spec.	Qty.	Color.	Maker.	Remark.
1	HOUSING	YBH250-05	1	WHT	YEONHO	
	TERMINAL	YBAT-200	5		YEONHO	
2	HOUSING	SMH-250-05L	1	WHT	YEONHO	
	TERMINAL	YST-025L	5		YEONHO	
	RETAINER	SMH-250-05RT	1	RED	YEONHO	
3	CABLE	AWM2095 VW-1 80°C 300V 26AWG -F- RoHS LF SHIN HWA	1	YELLOW	SHIN HWA	A1 – B1 (Vcc, T1)
				PINK		A2 – B2 (Temp-AD, T1)
				ORANGE		A3 – B3 (Humi-PWM1)
				RED		A4 – B4 (Humi-AD)
				BLUE		A5 – B5 (Humi-PWM2)

Product Inspection

Inspection/test item	Criteria	Measuring tool	Relation process
1. Resistance (Rp, kΩ)	Standard characteristic satisfaction * Humidity sensor : 19.9 ~57.4 kΩ(±5%RH) * Thermistor(T1) : 47.5 ~ 52.5 kΩ (±5%) * Thermistor(T2) : 47.5 ~ 52.5 kΩ (±5%) * Measured Frequency : AC 1Vrms, 1 kHz * Measured Temperature : 25°C * Measured Humidity : 60%RH	LCR Meter Chamber	Final test
2. Wrong, missing wiring	Wiring regular position (There is nothing cross position)	Eye	Incoming Inspection
3. Open	There is nothing open, dent and harmful thing in the wire.	Multi Meter	
4. Appearance	There is nothing wrong, missing, inverse mount and etc on the PCB.	Magnifying glass (Lupe)	

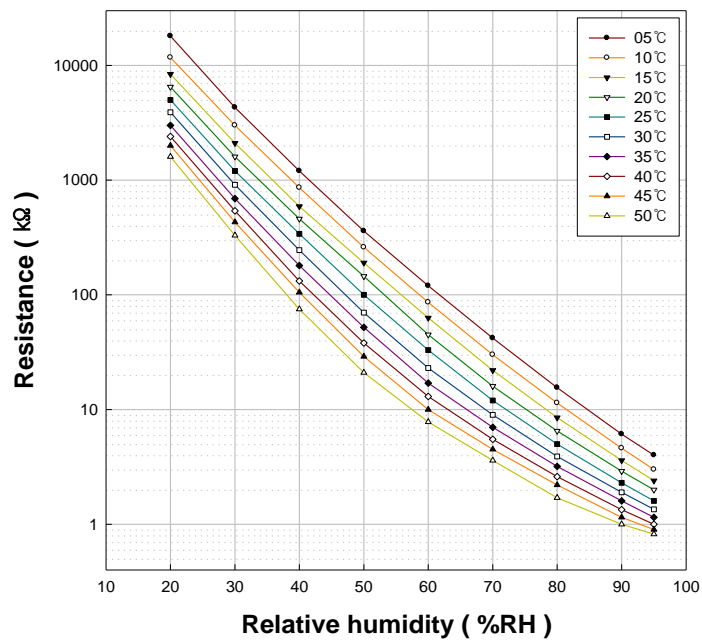
Standard Characteristics (Sensor)

(25°C, 1V_{RMS}, 1kHz)



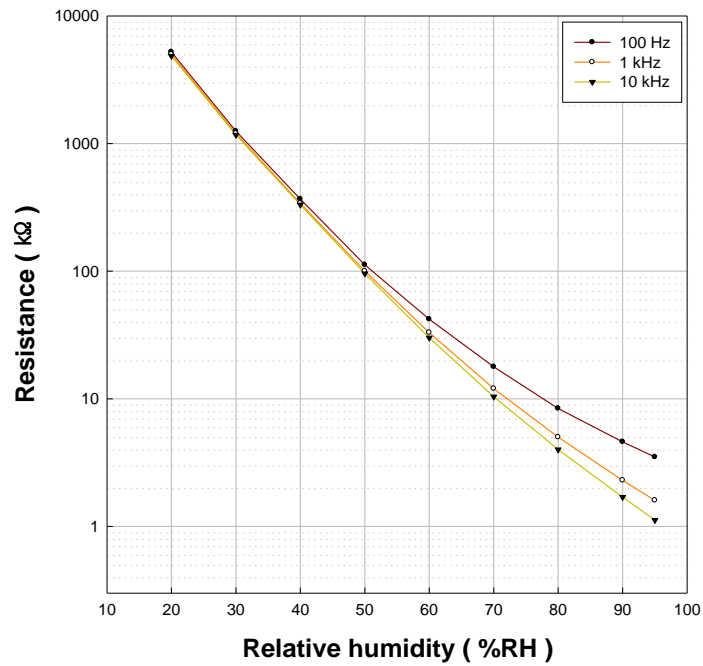
Temperature Characteristics (Sensor)

(1V_{RMS}, 1kHz)

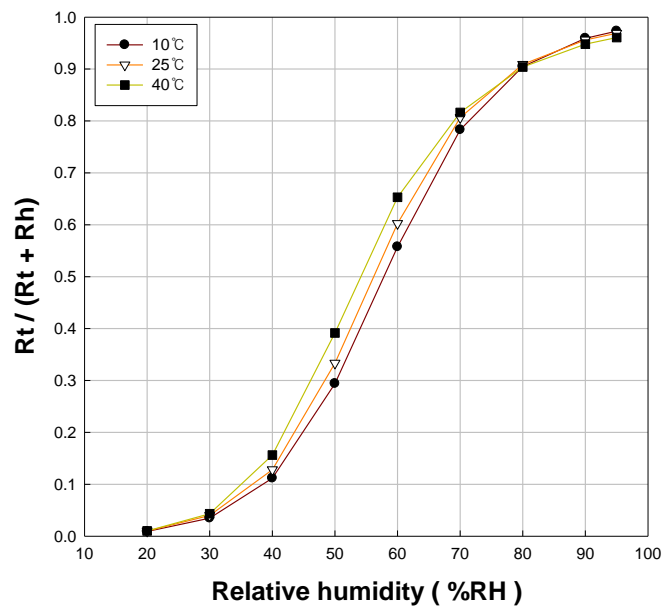


Frequency Characteristics (Sensor)

(25°C, 1V_{RMS})

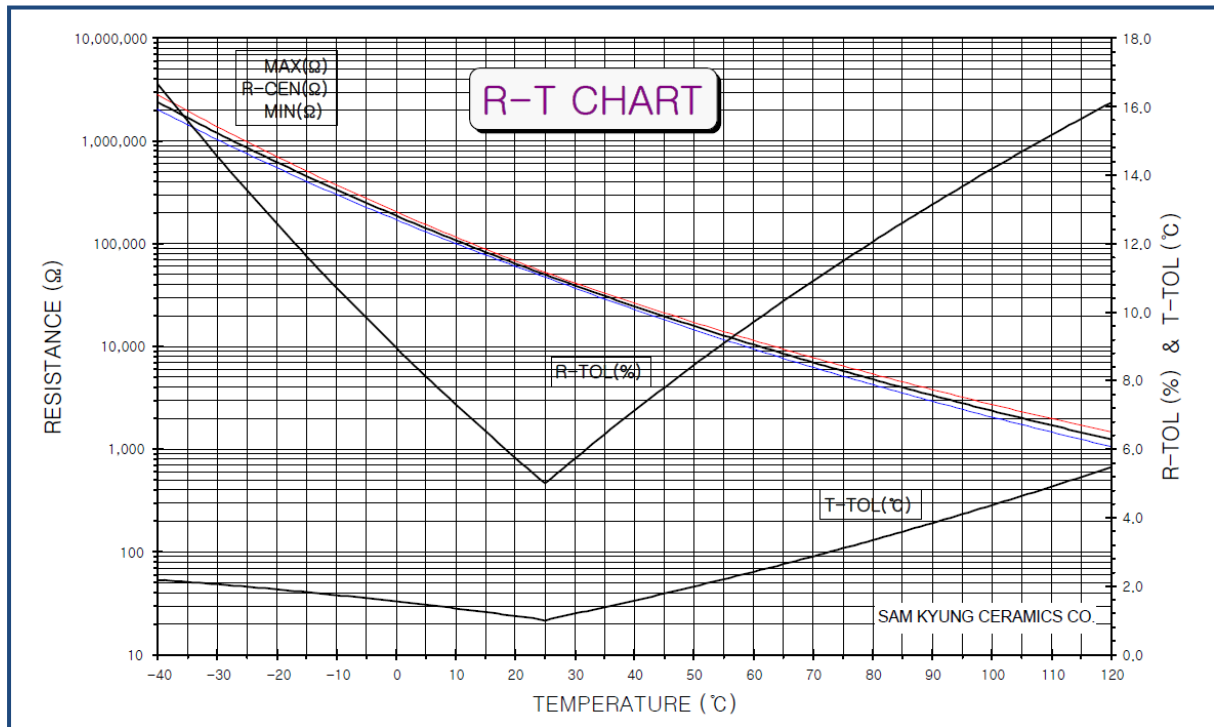


Temperature Characteristics (SY-HS-25NT module)



(R_t : Termistor resistance / R_h : Sensor resistance)

Temperature Look-up Table (NTC-50KD-5J)



TEMP. (°C)	RESISTANCE (Ω)			RESIST.-TOL. (%)		TEMP.-TOL. (°C)	
	MIN	CENTER	MAX	MAX	MIN	MAX	MIN
-40	2017160	2384343	2811319	17.91	15.4	2.36	2.03
-39	1882895	2220901	2613036	17.66	15.22	2.34	2.02
-38	1758256	2069500	2429750	17.41	15.04	2.32	2.01
-37	1642510	1929197	2260258	17.16	14.86	2.31	2
-36	1534980	1799128	2103459	16.92	14.68	2.29	1.99
-35	1435046	1678497	1958342	16.67	14.5	2.27	1.98
-34	1342135	1566578	1823983	16.43	14.33	2.26	1.97
-33	1255720	1462699	1699534	16.19	14.15	2.24	1.96
-32	1175319	1366246	1584218	15.95	13.97	2.22	1.95
-31	1100482	1276652	1477321	15.72	13.8	2.21	1.94
-30	1030801	1193399	1378191	15.48	13.62	2.19	1.93
-29	965894	1116006	1286225	15.25	13.45	2.17	1.92
-28	905412	1044035	1200872	15.02	13.28	2.15	1.9

-27	849034	977080	1121626	14.79	13.1	2.14	1.89
-26	796460	914767	1048021	14.57	12.93	2.12	1.88
-25	747416	856753	979629	14.34	12.76	2.1	1.87
-24	701649	802720	916055	14.12	12.59	2.08	1.86
-23	658924	752377	856937	13.9	12.42	2.06	1.85
-22	619024	705454	801943	13.68	12.25	2.05	1.83
-21	581749	661703	750764	13.46	12.08	2.03	1.82
-20	546914	620893	703117	13.24	11.91	2.01	1.81
-19	514348	582814	658743	13.03	11.75	1.99	1.79
-18	483891	547269	617401	12.81	11.58	1.97	1.78
-17	455398	514078	578868	12.6	11.41	1.95	1.77
-16	428731	483073	542942	12.39	11.25	1.93	1.75
-15	403766	454101	509433	12.18	11.08	1.91	1.74
-14	380386	427017	478166	11.98	10.92	1.89	1.73
-13	358482	401691	448982	11.77	10.76	1.87	1.71
-12	337955	377999	421731	11.57	10.59	1.85	1.7
-11	318710	355828	396276	11.37	10.43	1.83	1.68
-10	300662	335074	372490	11.17	10.27	1.81	1.67
-9	283731	315639	350256	10.97	10.11	1.79	1.65
-8	267842	297432	329465	10.77	9.95	1.77	1.64
-7	252926	280371	310017	10.57	9.79	1.75	1.62
-6	238919	264378	291818	10.38	9.63	1.73	1.61
-5	225761	249380	274782	10.19	9.47	1.71	1.59
-4	213396	235312	258829	9.99	9.31	1.69	1.57
-3	201774	222111	243886	9.8	9.16	1.67	1.56
-2	190845	209719	229883	9.61	9	1.65	1.54
-1	180565	198083	216756	9.43	8.84	1.63	1.52
0	170893	187153	204448	9.24	8.69	1.6	1.51
1	161789	176883	192902	9.06	8.53	1.58	1.49
2	153218	167230	182069	8.87	8.38	1.56	1.47
3	145145	158155	171899	8.69	8.23	1.54	1.46

4	137540	149618	162351	8.51	8.07	1.52	1.44
5	130373	141587	153382	8.33	7.92	1.49	1.42
6	123616	134029	144956	8.15	7.77	1.47	1.4
7	117245	126914	137036	7.98	7.62	1.45	1.38
8	111236	120213	129589	7.8	7.47	1.43	1.36
9	105565	113900	122586	7.63	7.32	1.4	1.35
10	100213	107952	115997	7.45	7.17	1.38	1.33
11	95160.4	102345	109796	7.28	7.02	1.36	1.31
12	90388.4	97057.9	103959	7.11	6.87	1.33	1.29
13	85880.4	92071.5	98462.1	6.94	6.72	1.31	1.27
14	81620.5	87366.9	93284.1	6.77	6.58	1.29	1.25
15	77593.9	82927	88405.1	6.61	6.43	1.26	1.23
16	73786.8	78735.6	83806.2	6.44	6.29	1.24	1.21
17	70186	74777.5	79470.2	6.28	6.14	1.21	1.19
18	66779.5	71038.7	75380.7	6.11	6	1.19	1.17
19	63555.8	67506	71522.5	5.95	5.85	1.17	1.15
20	60504.3	64167.1	67881.6	5.79	5.71	1.14	1.12
21	57614.9	61010.4	64444.6	5.63	5.57	1.12	1.1
22	54878.3	58025.2	61199.1	5.47	5.42	1.09	1.08
23	52285.7	55201.3	58133.7	5.31	5.28	1.07	1.06
24	49828.9	52529.2	55237.3	5.16	5.14	1.04	1.04
25	47500	50000	52500	5	5	0.99	0.99
26	45158.7	47605.5	50059.4	5.15	5.14	1.05	1.05
27	42944.6	45337.8	47744.7	5.31	5.28	1.09	1.09
28	40850.4	43189.7	45548.8	5.46	5.42	1.13	1.12
29	38868.8	41154.2	43465.1	5.62	5.55	1.17	1.16
30	36993.4	39225	41487.2	5.77	5.69	1.21	1.19
31	35217.9	37395.9	39609.4	5.92	5.82	1.25	1.23
32	33536.6	35661.4	37826	6.07	5.96	1.29	1.26
33	31944	34016.1	36132	6.22	6.09	1.33	1.3
34	30435.1	32455	34522.4	6.37	6.22	1.37	1.34

35	29005	30973.3	32992.6	6.52	6.36	1.41	1.37
36	27649.2	29566.8	31538.3	6.67	6.49	1.45	1.41
37	26363.7	28231.2	30155.4	6.82	6.62	1.49	1.44
38	25144.3	26962.6	28840.1	6.96	6.74	1.53	1.48
39	23987.4	25757.4	27588.8	7.11	6.87	1.57	1.52
40	22889.5	24612	26398	7.26	7	1.61	1.56
41	21847.3	23523.3	25264.6	7.4	7.12	1.65	1.59
42	20857.8	22488.2	24185.5	7.55	7.25	1.7	1.63
43	19918	21503.8	23157.8	7.69	7.37	1.74	1.67
44	19025.2	20567.4	22179	7.84	7.5	1.78	1.71
45	18176.8	19676.4	21246.4	7.98	7.62	1.83	1.74
46	17370.5	18828.4	20357.6	8.12	7.74	1.87	1.78
47	16603.9	18021.1	19510.4	8.26	7.86	1.91	1.82
48	15874.9	17252.4	18702.7	8.41	7.98	1.96	1.86
49	15181.5	16520.4	17932.4	8.55	8.1	2	1.9
50	14521.8	15823	17197.6	8.69	8.22	2.05	1.94
51	13894	15158.4	16496.5	8.83	8.34	2.09	1.98
52	13296.5	14525.1	15827.5	8.97	8.46	2.14	2.01
53	12727.5	13921.3	15188.9	9.11	8.58	2.18	2.05
54	12185.7	13345.5	14579.2	9.24	8.69	2.23	2.09
55	11669.6	12796.4	13997	9.38	8.81	2.27	2.13
56	11177.8	12272.6	13440.8	9.52	8.92	2.32	2.17
57	10709.2	11772.7	12909.5	9.66	9.03	2.37	2.21
58	10262.5	11295.7	12401.7	9.79	9.15	2.41	2.25
59	9836.6	10840.3	11916.4	9.93	9.26	2.46	2.29
60	9430.43	10405.4	11452.5	10.06	9.37	2.51	2.33
61	9043	9990.13	11008.9	10.2	9.48	2.55	2.38
62	8673.36	9593.42	10584.6	10.33	9.59	2.6	2.42
63	8320.6	9214.38	10178.7	10.46	9.7	2.65	2.46
64	7983.89	8852.15	9790.3	10.6	9.81	2.7	2.5
65	7662.43	8505.9	9418.6	10.73	9.92	2.75	2.54

66	7355.45	8174.86	9062.8	10.86	10.02	2.8	2.58
67	7062.23	7858.28	8722.2	10.99	10.13	2.85	2.62
68	6782.11	7555.49	8396	11.12	10.24	2.9	2.67
69	6514.44	7265.81	8083.6	11.26	10.34	2.95	2.71
70	6258.6	6988.61	7784.3	11.38	10.45	3	2.75
71	6014.03	6723.32	7497.5	11.51	10.55	3.05	2.79
72	5780.18	6469.36	7222.6	11.64	10.65	3.1	2.83
73	5556.53	6226.19	6959.1	11.77	10.76	3.15	2.88
74	5342.6	5993.33	6706.5	11.9	10.86	3.2	2.92
75	5137.91	5770.27	6464.3	12.03	10.96	3.25	2.96
76	4942.03	5556.57	6231.9	12.15	11.06	3.3	3.01
77	4754.54	5351.79	6009	12.28	11.16	3.36	3.05
78	4575.05	5155.52	5795.13	12.41	11.26	3.41	3.09
79	4403.17	4967.38	5589.87	12.53	11.36	3.46	3.14
80	4238.56	4786.98	5392.85	12.66	11.46	3.51	3.18
81	4080.87	4613.98	5203.7	12.78	11.55	3.57	3.23
82	3929.79	4448.05	5022.07	12.91	11.65	3.62	3.27
83	3785	4288.85	4847.63	13.03	11.75	3.68	3.31
84	3646.22	4136.1	4680.06	13.15	11.84	3.73	3.36
85	3513.18	3989.5	4519.07	13.27	11.94	3.78	3.4
86	3385.61	3848.78	4364.37	13.4	12.03	3.84	3.45
87	3263.26	3713.67	4215.68	13.52	12.13	3.89	3.49
88	3145.9	3583.93	4072.75	13.64	12.22	3.95	3.54
89	3033.3	3459.33	3935.32	13.76	12.32	4	3.58
90	2925.26	3339.63	3803.17	13.88	12.41	4.06	3.63
91	2821.55	3224.63	3676.07	14	12.5	4.12	3.68
92	2722	3114.11	3553.8	14.12	12.59	4.17	3.72
93	2626.42	3007.89	3436.16	14.24	12.68	4.23	3.77
94	2534.64	2905.79	3322.95	14.36	12.77	4.29	3.81
95	2446.48	2807.61	3214	14.47	12.86	4.34	3.86
96	2361.79	2713.2	3109.11	14.59	12.95	4.4	3.91

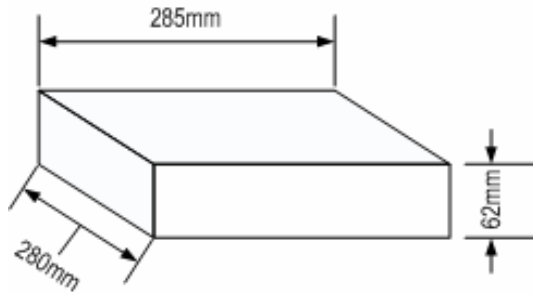
97	2280.42	2622.4	3008.13	14.71	13.04	4.46	3.95
98	2202.22	2535.05	2910.88	14.83	13.13	4.52	4
99	2127.06	2451	2817.23	14.94	13.22	4.58	4.05
100	2054.8	2370.13	2727.01	15.06	13.3	4.64	4.1
101	1985.33	2292.29	2640.09	15.17	13.39	4.69	4.14
102	1918.51	2217.36	2556.34	15.29	13.48	4.75	4.19
103	1854.25	2145.21	2475.62	15.4	13.56	4.81	4.24
104	1792.43	2075.74	2397.82	15.52	13.65	4.87	4.29
105	1732.95	2008.83	2322.81	15.63	13.73	4.93	4.33
106	1675.71	1944.38	2250.49	15.74	13.82	4.99	4.38
107	1620.62	1882.29	2180.74	15.86	13.9	5.05	4.43
108	1567.58	1822.45	2113.46	15.97	13.98	5.12	4.48
109	1516.52	1764.79	2048.57	16.08	14.07	5.18	4.53
110	1467.35	1709.21	1985.95	16.19	14.15	5.24	4.58
111	1419.99	1655.62	1925.53	16.3	14.23	5.3	4.63
112	1374.37	1603.96	1867.22	16.41	14.31	5.36	4.68
113	1330.42	1554.13	1810.93	16.52	14.39	5.43	4.73
114	1288.06	1506.08	1756.59	16.63	14.48	5.49	4.78
115	1247.25	1459.72	1704.12	16.74	14.56	5.55	4.83
116	1207.9	1415	1653.45	16.85	14.64	5.61	4.88
117	1169.98	1371.84	1604.51	16.96	14.71	5.68	4.93
118	1133.4	1330.19	1557.24	17.07	14.79	5.74	4.98
119	1098.14	1289.98	1511.56	17.18	14.87	5.81	5.03
120	1064.12	1251.17	1467.43	17.28	14.95	5.87	5.08

Packaging

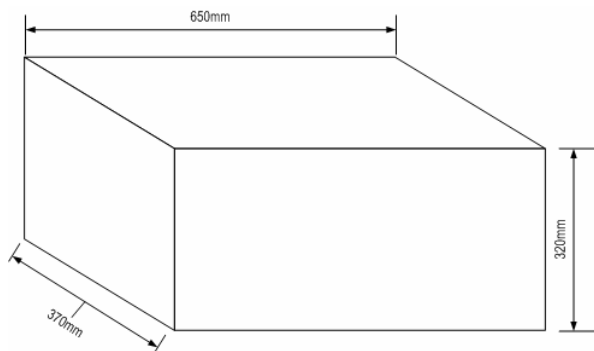
Packaging Standard

Type	Quantity (pcs.)		Size (W x L x H mm)	
	Inner box	Out box	Inner box	Out box
SY – HS-25NT	50	600	285x280x62	650x370x320

Inner box



Out box



Revision History

Date	Version	Page	Change
NOV. 27, 2014	V1.5		
NOV. 26, 2015	V1.6	1-18	<ul style="list-style-type: none">- Company logo changed.- Cable Maker changed.- CTQ contents deleted.- PIN Out Assignment added.- Temperature Look-up Table changed.



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SAMYOUNG S&C Co., Ltd.

150, Sangdaewon-dong, Jungwon-gu,
Seongnam-city, Gyeonggi-do, 462-807
Korea

Phone: +82-31-741-1830

Fax : +82-31-741-1821

E-mail: sales@samyoungsnc.com

Homepage: www.samyoungsnc.com

This Application Guide should be used only for intended and authorized application of **SY-HS-25NT**.

Please consult with **SAMYOUNG S&C** for any specific application requirements and for detailed datasheet.

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