Specification

For

LTCC 3dB Hybrid Coupler

Model Name : RCP650A03

Customer :

Title:

Name :

APPROVED

By Date : _____

Signature : _____

RN2 Technologies co., Ltd.

RN2 Technologies co., Ltd.
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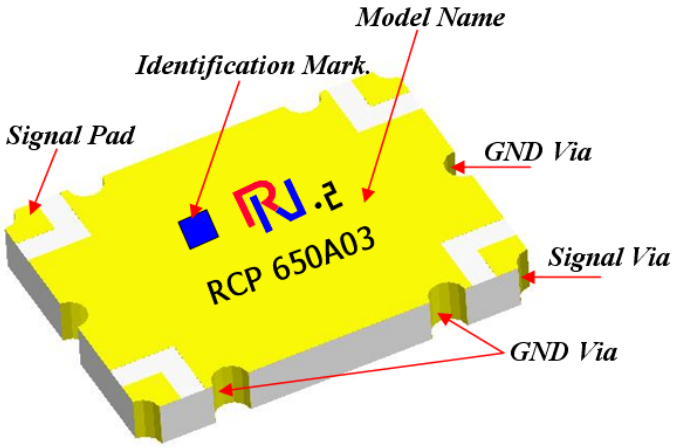
*Issued Date :*_____

Designed : _____

Approved : _____

1. Description

1-1. Part number: RCP650A03



1-2. Features

- Hybrid Coupler 3dB, 90˚
- Surface mount type
- Suitable for operation frequency 470~860MHz
- **RoHS** compliance
- High stability in temperature and humidity for LTCC base
- Low loss for Silver(Ag) conductor
- Miniature size and high power capability
- Lead-free alloy solderable
- Thermal expansion corresponding with common substrate

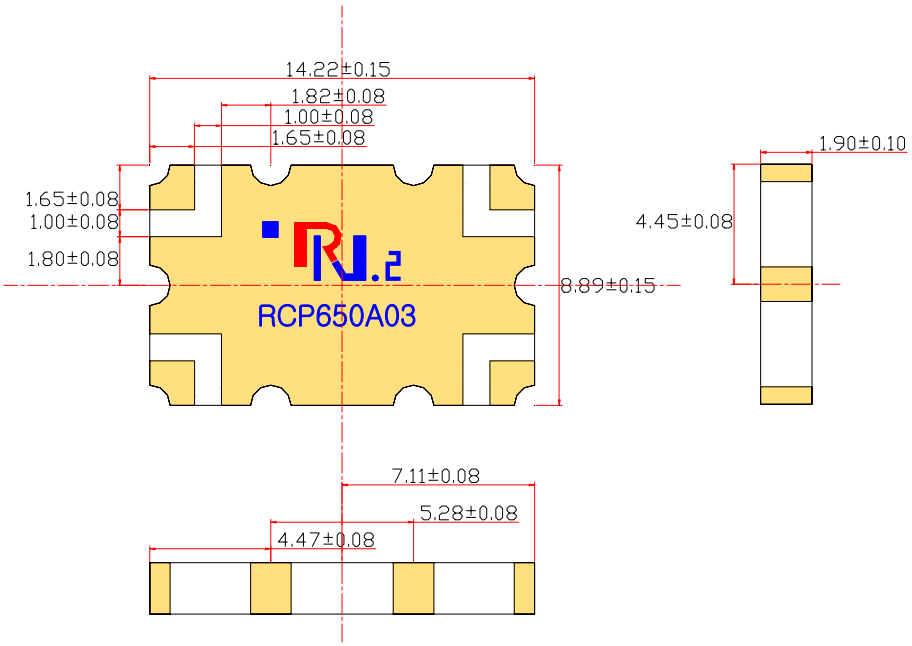
2. Electrical Specification

Freq.	Amplitude Balance	Isolation	Insertion Loss
(MHz)	max (dB)	min (dB)	max (dB)
470-860	± 0.45	-20	-0.3
VSWR	**Phase**	**Power Capacity**	**Operating Temp.**
Max	(degrees)	Avg. (Watt)	(℃)
1.2	90 ± 3.0	200	-55 to +125

3. Mechanical Specification

3-1. Outline Dimension

PROJECTION	NO.	DATE	REVISION & DESCRIPTION	SIGNATURE REVIEWED	SIGNATURE CHECKED
	1	2008.07.15	New-Drawing		
	2				
	3				



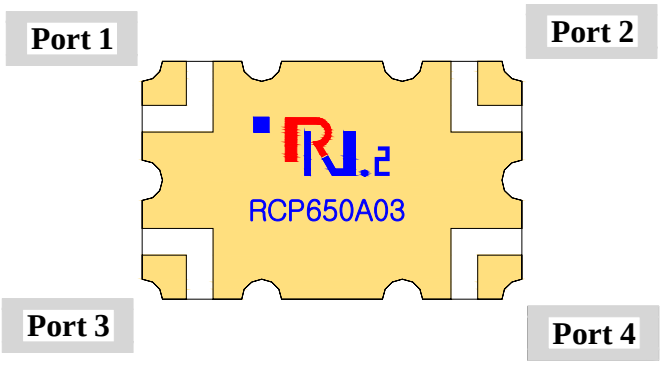
Note.
1. SMD-type, Ceramic Base.
2. Inner signal circuits : Silver(Ag) conductor
3. Surface plating : Gold(Au) finished
4. Tolerance is not cumulative.

NO.	DESCRIPTION	UNIT / TOTAL QUANTITY			
TITLE	RCP650A03-Outline	RN2 DWG NO.	08-0715-01	SCALE 1/1	
				SIZE A4	DIMENSION mm

3-2. Weight

- 1.35 Grams typical

4. Port Configuration



Configuration	Port 1	Port 2	Port 3	Port 4
Case 1.	Input	Isolated	Coupling -3dB, 0˚	Output -3dB, -90˚
Case 2.	Isolated	Input	Output -3dB, 90˚	Coupling -3dB, 0˚
Case 3.	Coupling -3dB, 0˚	Output -3dB, 90˚	Input	Isolated
Case 4.	Output -3dB, 90˚	Coupling -3dB, 0˚	Isolated	Input

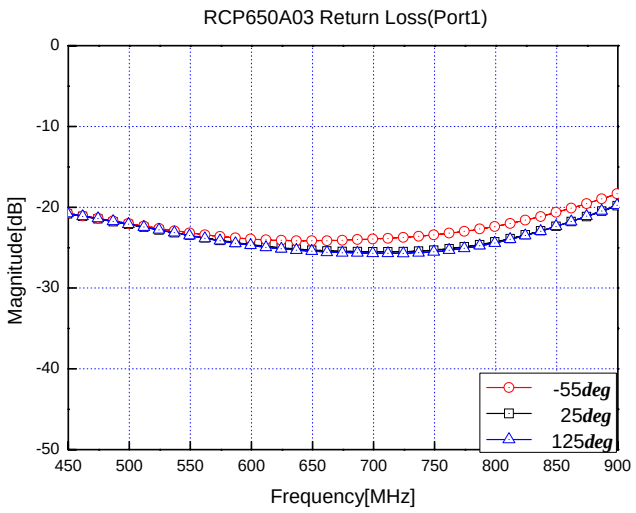
* Once Port 1 is determined, the other three ports are defined automatically.

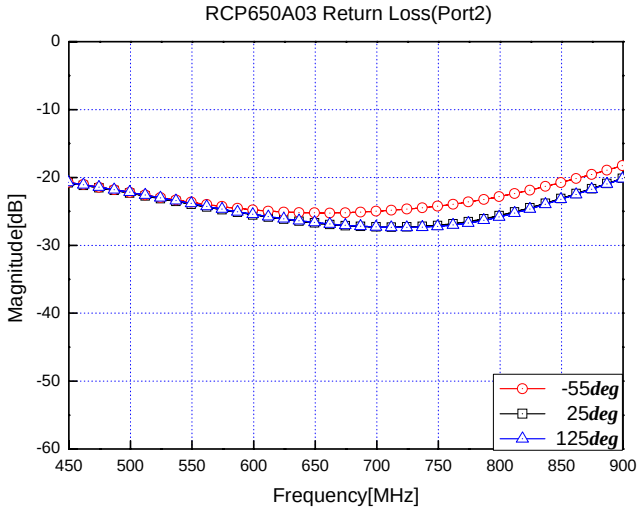
5. Schematic Drawing

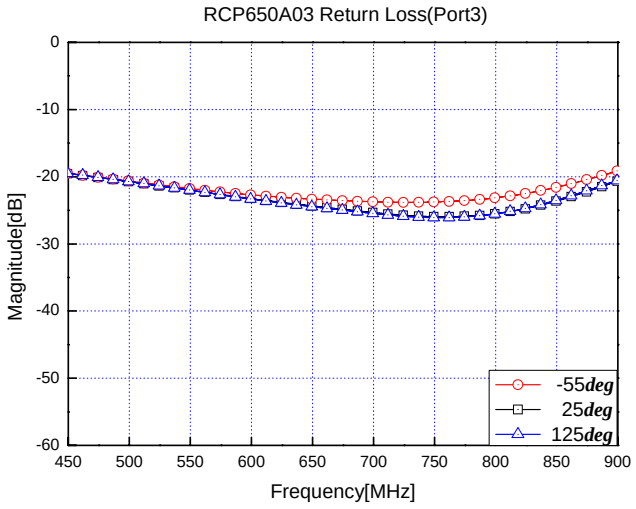
6. Typical Performance Data (25℃)

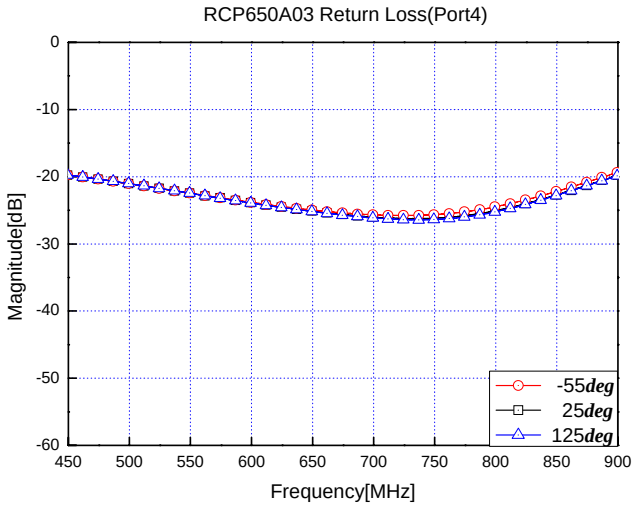
Freq. [MHz]	Coupling [dB]	Out [dB]	IL [dB]	Amp.Bal. [dB]	Phase [degree]	Return Loss [dB]			
						S11	S22	S33	S44
470	-3.5363	-2.8655	-0.1777	±0.34	-90.06	-21.33	-21.37	-20.00	-20.11
490	-3.42	-2.9587	-0.1729	±0.23	-90.2	-21.87	-22.04	-20.48	-20.46
510	-3.3201	-3.0477	-0.1715	±0.14	-90.33	-22.42	-22.65	-21.01	-20.96
530	-3.2321	-3.1301	-0.1705	±0.05	-90.49	-22.98	-23.32	-21.51	-21.50
550	-3.1485	-3.1975	-0.1626	±0.02	-90.57	-23.49	-23.97	-22.02	-22.01
570	-3.094	-3.2573	-0.1646	±0.08	-90.83	-24.01	-24.61	-22.55	-22.55
590	-3.0387	-3.3168	-0.1652	±0.14	-90.81	-24.43	-25.22	-23.02	-23.08
610	-2.9971	-3.3577	-0.1634	±0.18	-90.92	-24.79	-25.78	-23.49	-23.57
630	-2.969	-3.3952	-0.1666	±0.21	-91.01	-25.07	-26.29	-23.95	-24.05
650	-2.9349	-3.4229	-0.1617	±0.24	-91.02	-25.29	-26.73	-24.36	-24.46
670	-2.9378	-3.4465	-0.1744	±0.25	-91	-25.44	-27.06	-24.77	-24.88
690	-2.9431	-3.4656	-0.1862	±0.26	-91.02	-25.49	-27.25	-25.15	-25.28
710	-2.9544	-3.4467	-0.1833	±0.25	-91.07	-25.51	-27.33	-25.51	-25.66
730	-2.9661	-3.4279	-0.1806	±0.23	-91.18	-25.48	-27.26	-25.81	-25.95
750	-2.9919	-3.4013	-0.1815	±0.20	-91.17	-25.27	-27.04	-25.94	-26.07
770	-3.0482	-3.3729	-0.1972	±0.16	-91.2	-24.99	-26.63	-25.92	-26.01
790	-3.1114	-3.3335	-0.2107	±0.11	-91.09	-24.54	-25.99	-25.72	-25.75
810	-3.1963	-3.2801	-0.2277	±0.04	-91.2	-23.92	-25.17	-25.25	-25.23
830	-3.2842	-3.2028	-0.233	±0.04	-91.27	-23.20	-24.17	-24.54	-24.48
850	-3.4034	-3.136	-0.2573	±0.13	-91.23	-22.32	-23.08	-23.59	-23.49
860	-3.4587	-3.0824	-0.2562	±0.19	-91.32	-21.85	-22.50	-23.06	-22.94

7. Operation Temperature Curve (a)

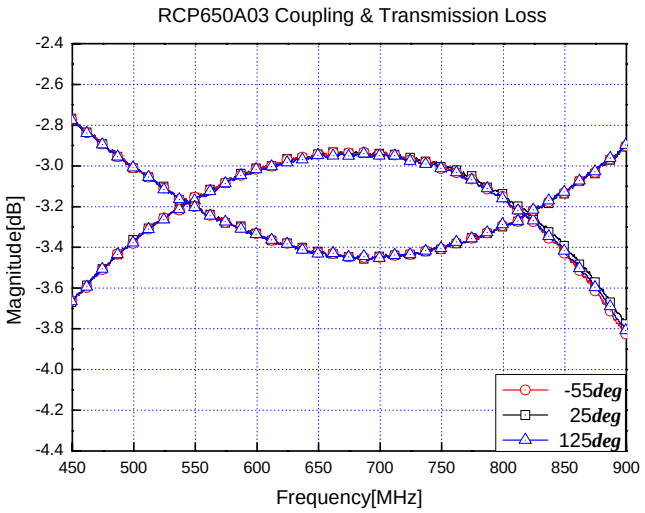


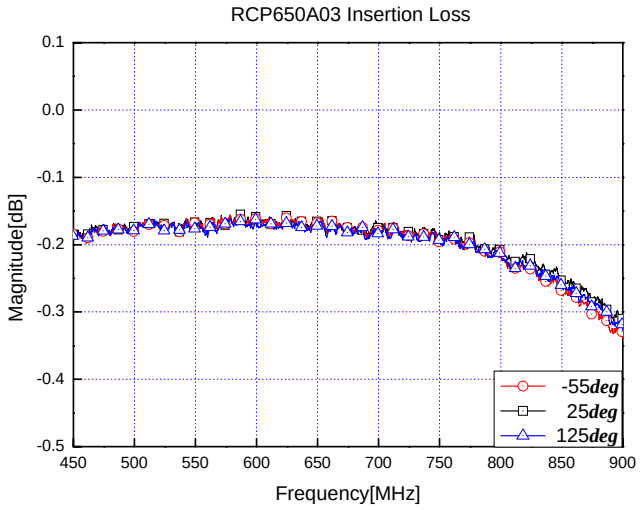


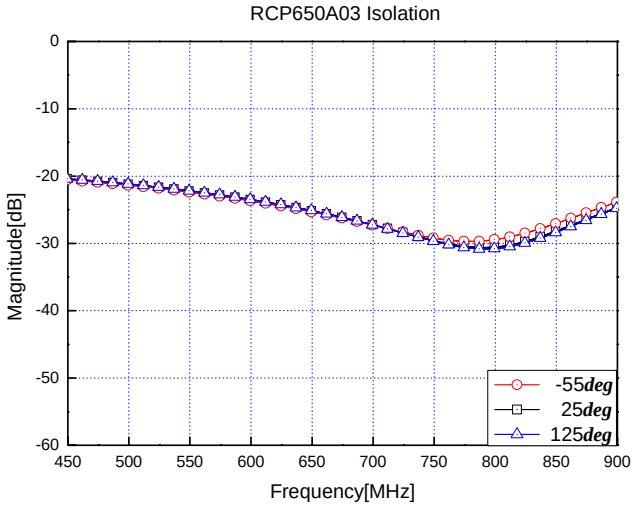


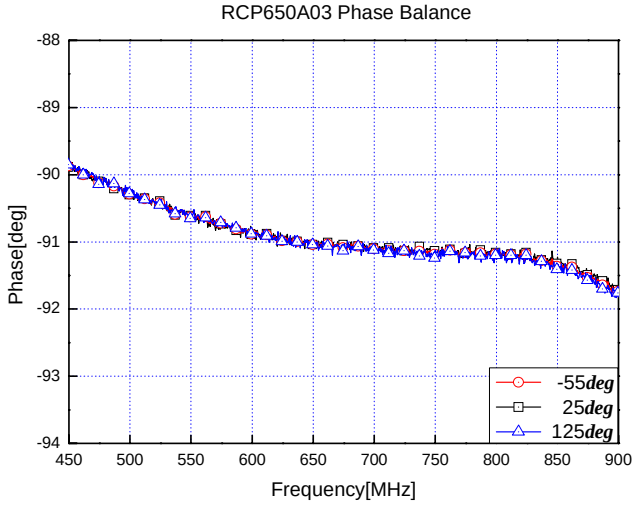


8. Operation Temperature Curve (b)

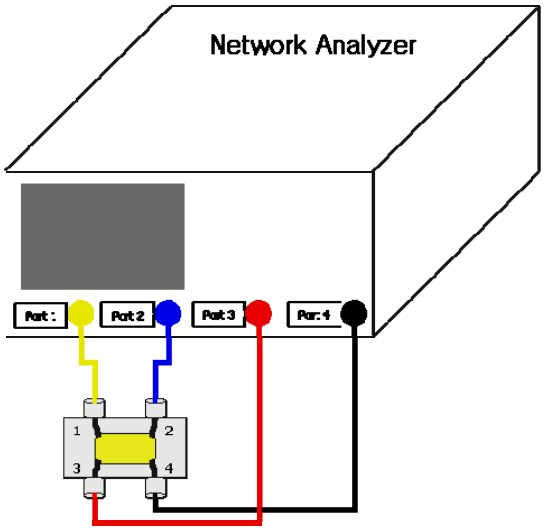








9. Test Method



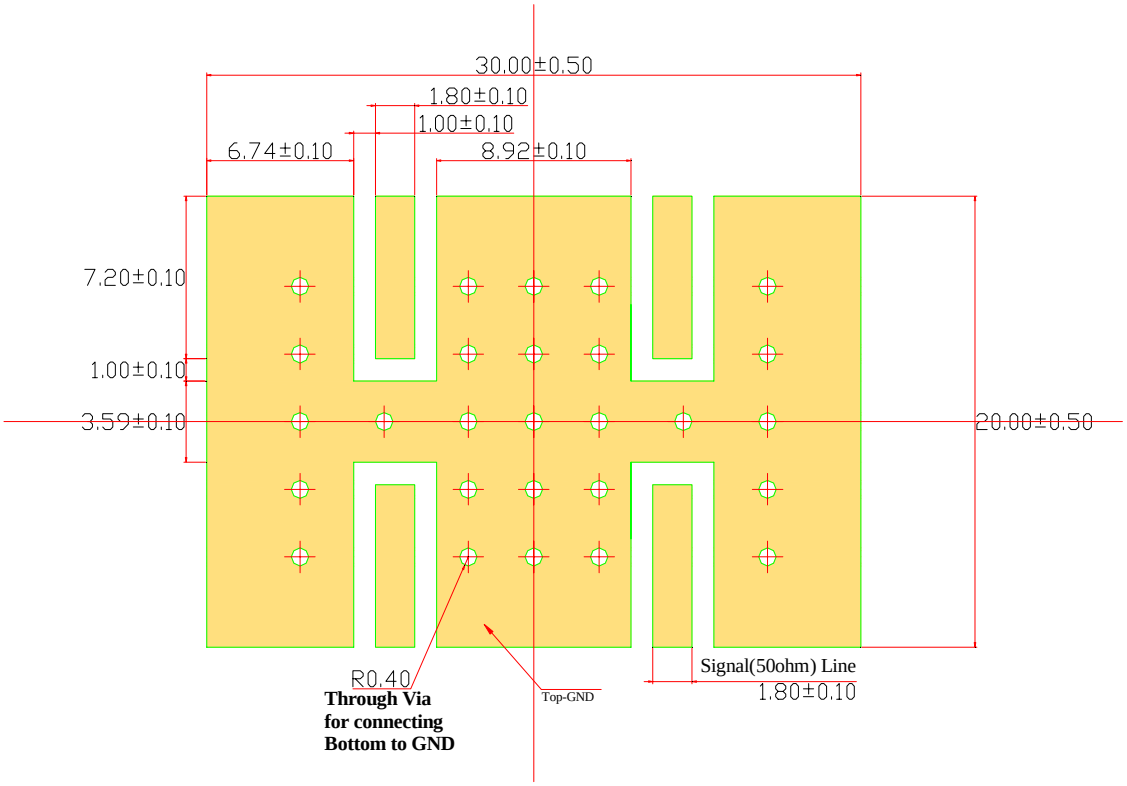
- Refer to ‘Case 1’ of ‘4. Port Configuration’ on page 4
- Have the network analyzer calibrated properly.
- Measure the data of **Coupling** through port 1 to port 3. (S31)
- Measure the data of **Transmission** through port 1 to port 4. (S41)
- Measure the data of **Isolation** through port 1 to port 2. (S21)
- Calculate the **Insertion Loss** and **Amplitude Balance** of coupler on the below power method formula.

	S-Parameter[dB]	Power Method[dB]
Coupling	S31	$10 \cdot \log\left(\frac{P_{cou}}{P_{in}}\right)$
Transmission Loss	S41	$10 \cdot \log\left(\frac{P_{out}}{P_{in}}\right)$
Isolation	S21	$10 \cdot \log\left(\frac{P_{iso}}{P_{in}}\right)$
Insertion Loss		$10 \cdot \log\left(\frac{P_{in}}{P_{cou}+P_{out}}\right)$
Amplitude Balance		$10 \cdot \log\left(\frac{P_{cou}}{\frac{P_{cou}+P_{out}}{2}}\right)$
Phase Balance	$\text{Phase}_{(S31)} - \text{Phase}_{(S41)}$	

P_{in} : Power of Input Port P_{out} : Power of Output Port
P_{cou} : Power of Coupling Port P_{iso} : Power of Isolated Port

10. Measurement board layout

PROJECTION	No.	DATE	REVISION & DESCRIPTION	SIGNATURE	
				REVIEWED	CHECKED
	1	2008.07.15	New - Drawing		
	2				
	3				

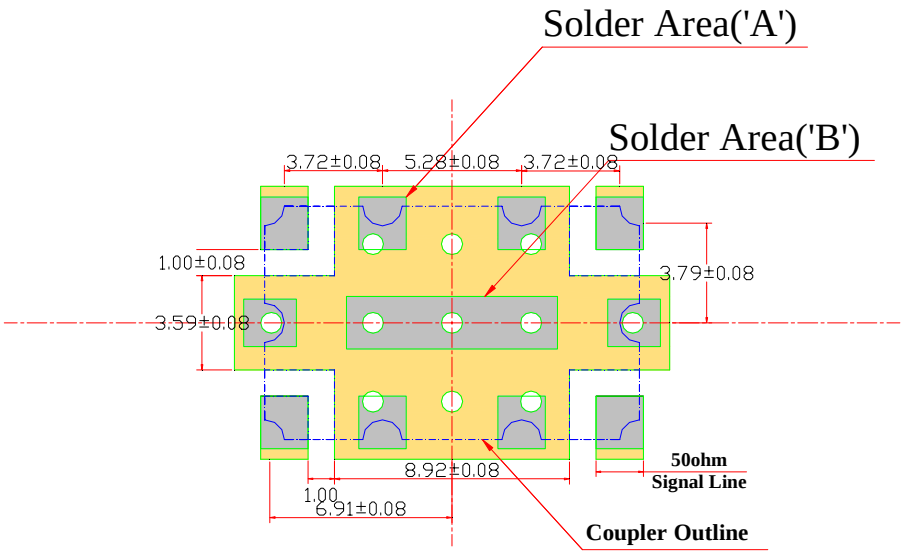


NOTE. Signal line width is shown for the conditions of;
1. RF-35 (Taconic) board
2. Dielectric contance 3.5
3. Board thickness 0.8mm
4. Copper thickness 1/2 oz.

No.	DESCRIPTION	UNIT QUANTITY	TOTAL	PERUNIT	TOTAL		
TITLE	RCP650A03-Measuremnet Board Outline	RN2 DWG No.	08-0715-02	SCALE	1/1		
				SIZE	A4	DIMENSION	mm

11. Recommended PCB layout and Solder mask pattern

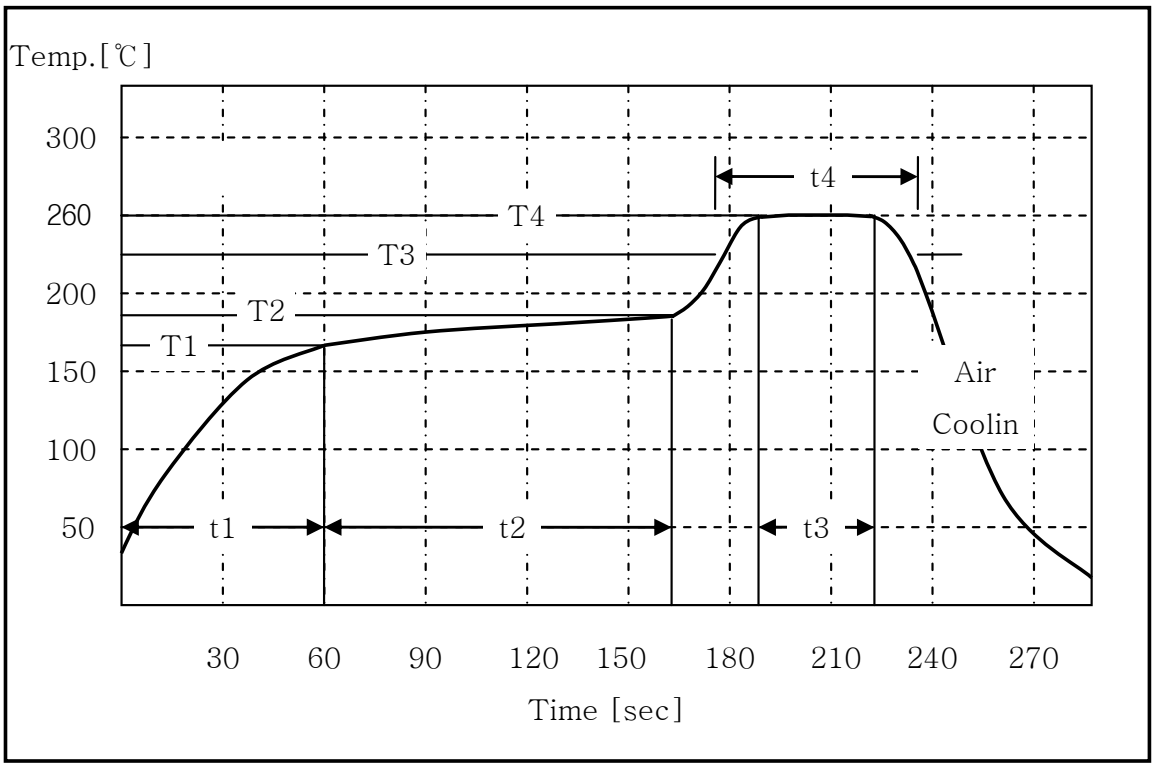
PROJECTION	NO.	DATE	REVISION & DESCRIPTION	SIGNATURE	
				REVIEWED	CHECKED
	1	2008.07.15	New-Drawing		
	2				
	3				



NOTE.
1. Test Solder Cream : SAC-305 (Alpa Metal)
2. Lead Free Solder Alloy : Sn/Ag/Cu Ratio Of 96.5/3.0/0.5
3. Solder Area ('A') Demension : 2.0 mm by 1.8 mm
4. Solder Area ('B') Demension : 2.0 mm by 8.0 mm

NO.	DESCRIPTION		UNIT QUANTITY	TOTAL		
TITLE	*A-Size_Recommended Solder Quantity & Area*	RN2 DWG NO.	08-0715-03	SCALE	1/1	
				SIZE	A4	DIMENSION mm

12. Reflow profile



	Ramp Up	Pre-Heating	Peak	Soaking
Temp.[℃]	**T1:160±5℃**	**T2:180±5℃**	**T4:260±5℃**	**T3:230±5℃**
Time [sec]	**t1:60±5sec**	**t2:100±15sec**	**t3:30±5sec**	**t4:60±10sec**

13. Using note for LTCC Couplers

I. Be careful when transporting

A. Excessive stress or shock may make products broken or cracked due to the nature of ceramics structure.

B. The products cracked or damaged on terminals may have their property changed.

II. Be careful during storage

A. Store the products in the temperature of -55 ~ 125℃

B. Keep the humidity at 45 ~ 75% around the products.

C. Prevent corrosive gas (Cl_2, NH_3, SO_X, NO_X, etc.) from contacting the products.

D. It is recommended to use the products within 6 months of receipt. If the period exceeds 6 months, solderability may need to be verified.

III. Be careful when soldering

A. All the ground terminals, IN and OUT pad of coupler should be soldered on the ground plane of the PCB.

B. Products may be cracked or broken by uneven forces from a claw or suction device.

C. Mechanical stress by any other devices may damage products when positioning them on PCB.

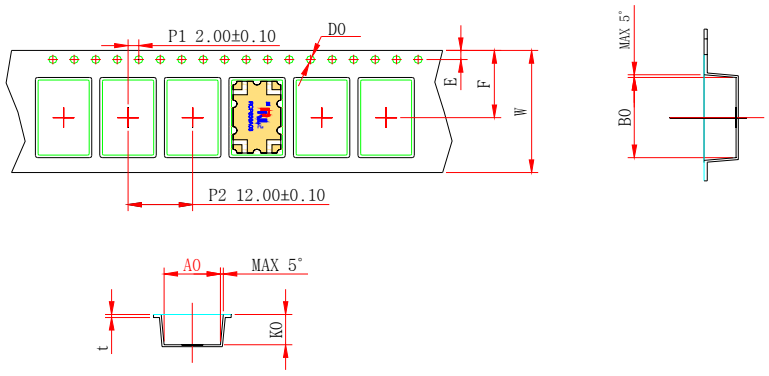
D. A dropped product is recommended not to be used.

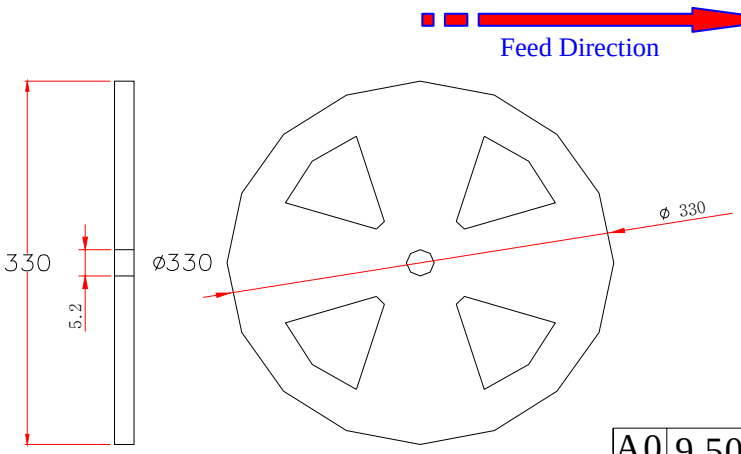
E. Soldering must be carried out by the condition of specification sheet.

F. Any couplers which are de-soldered from PCB should not be used again.

14. Packaging

PROJECTION	No.	DATE	REVISION & DESCRIPTION	SIGNATURE REVIEWED	SIGNATURE CHECKED
	1	2008.07.15	New Drawing		
	2				
	3				





A0	9.50±0.10	E	1.75±0.10
B0	14.90±0.10	F	11.50±0.10
D0	1.55±0.05	t	0.30±0.05
K0	2.30±0.10	w	24.00±0.30

Starndard Packaging Quantity : 2,000 PCS / Reel

No.	DESCRIPTION	UNIT QUANTITY	TOTAL		
TITLE	A-Size Packaging Dimension	RN2 DWG No.	08-0715-04	SCALE	1/1
				SIZE	A4 Dimension mm

15. Environmental Reliability

ITEM	PROCEDURE	REQUIREMENTS/RESULT
Temperature Cycle (Thermal Shock)	1. One Cycle : 30 min Step1: 125 ± 5 °C for 15 min Step2: -55 ± 5 °C for 15 min 2. Approach high or low temperature in 10 seconds 3. Number of Cycles : 100 4. Normal temperature for 1 hour	1. Meet the electrical Specification after test
Solderability	1. Solder : 230 ± 5°C for 5± 1 sec.	1. More than 85% of the I/O electrode pad shall be covered with solder.
Heat Resistance	1. Temperature : 100 ± 2 °C 2. Duration : 96 ± 2 hours	1. Meet the electrical Specification after test
Low Temp. Resistance	1. Temperature : -55 ± 5 °C 2. Duration : 24 ± 2 hours	1. Meet the electrical Specification after test
Vibration Resistance	1. Frequency: 5~ 15MHz 2. Acceleration : 10g 3. Sweep Time: 0.1 oct/min, 15min/axis 4. Axis : X, Y and Z direction	1. No appearance damage 2. Meet the electrical Specification after test
Humidity Resistance	1. One Cycle : Step1:increase Temperature -25~65°C for 2hours with humidity 85% Step2:Maintain for 4 hour after increasing Humidity 90% to 95% Step3: Decrease Temperature 65°C to 25°C 2. Number of Cycles : 10 3. Maintain for 3hour after decreasing temperature -10°C	1. Meet the electrical Specification after test
Drop Shock	1. Dropped onto hard wood from height of 50 cm for 5 times; each x, y and z direction except I/O direction.	1. No appearance damage 2. Meet the electrical Specification after test

16. RoHS test result

- **RN2 Technologies warrants and represents as follows.**

Test Report No. F690501/LF-CTSGP06-16067 Date: June 29, 2006 Page 2 of 3

Sample No. : GP06-16067.001
Sample Description : LTCC COUPLER
Style/Item No. : N/A
Comments : Materials are ceramics, Ag.

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium(Cd)	mg/kg	US EPA 3050B(1996), US EPA 6010B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3050B(1996), US EPA 6010B(1996), ICP	5	N.D.
Mercury (Hg)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	US EPA 3060A(1996), US EPA 7196A(1992), UV	1	N.D.

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Dibromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tribromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tetrabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Pentabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Hexabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Heptabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Octabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Nonabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Decabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Monobromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Dibromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tribromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Octabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Decabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.

NOTE: (1) N.D. = Not detected.(<MDL)
(2) ppm = mg/kg
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) Negative = Undetectable / Positive = Detectable