

Specification
For
LTCC 3dB Hybrid Coupler

Model Name : RCP1500Q03

Customer :

Title:

Name :

APPROVED

By Date : _____

Signature : _____

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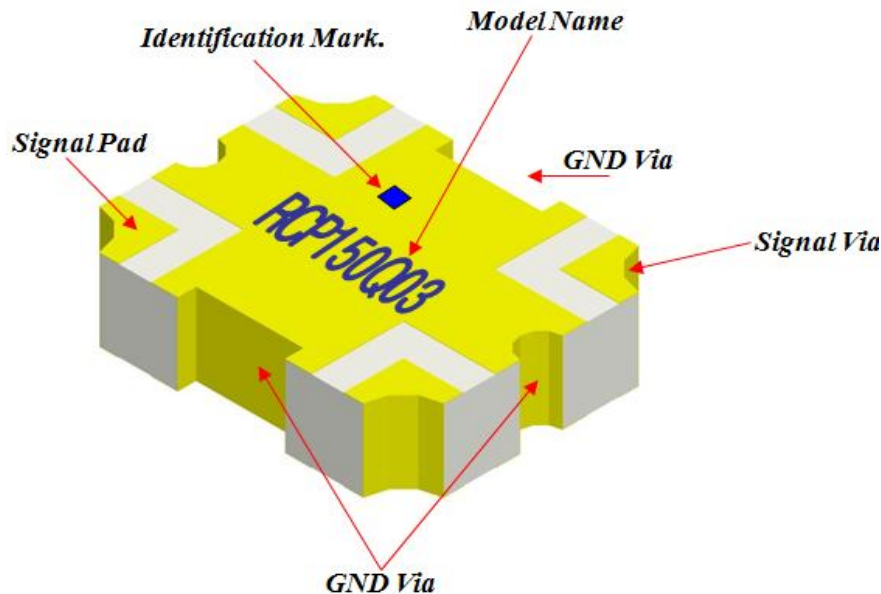
Issued Date : _____

Designed : _____

Approved : _____

1. Description

1-1. Part number: RCP1500Q03 (Denoted marking: RCP150Q03)



1-2. Features

- Hybrid Coupler 3dB, 90°
- Surface mount type
- Suitable for operation frequency 1200~1700MHz
- **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. (MHz)	Amplitude Balance max (dB)	Isolation min (dB)	Insertion Loss max (dB)
1200-1700	± 0.3	-20	-0.25
VSWR	Phase (degrees)	Power Capacity Avg. (Watt)	Operating Temp. (°C)
Max	90 ± 3.0	80	-55 to +125

3. Mechanical Specification

3-1. Outline Dimension

PROJECTION	NO.	DATE	REVISION & DESCRIPTION	SIGNATURE	
				REVIEWED	CHECKED
	1	2008.10.20	New-Drawing		
	2	2012.04.26	Marking revision		
	3				

Note.

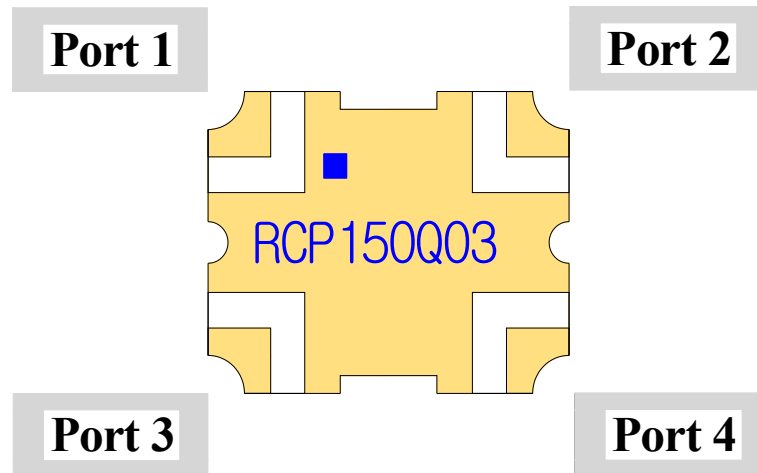
1. SMD-type, Ceramic Base.
2. Inner signal circuits : Silver(Ag) conductor
3. Surface plating : Gold(Au) finished
4. Tolerance is not cumulative.

NO.	DESCRIPTION	UNIT	TOTAL				
			QUANTITY				
TITLE	RCP150Q03-Outline	RN2 DWG NO.	08-1020-01	SCALE	A4	DIMENSION	mm
				SIZE			

3-2. Weight

- 0.14 ± 10% 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



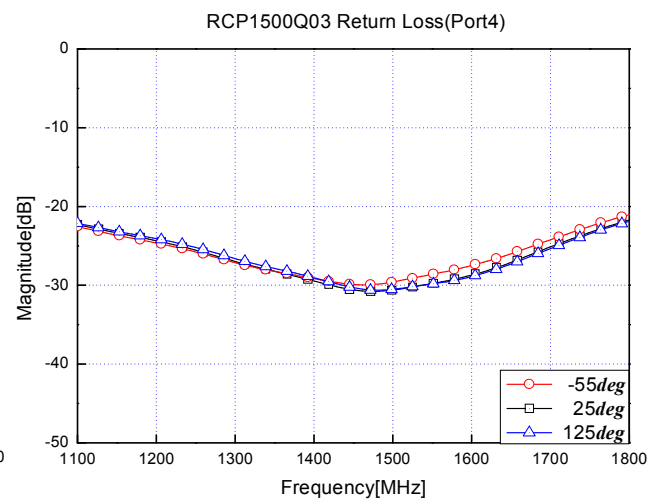
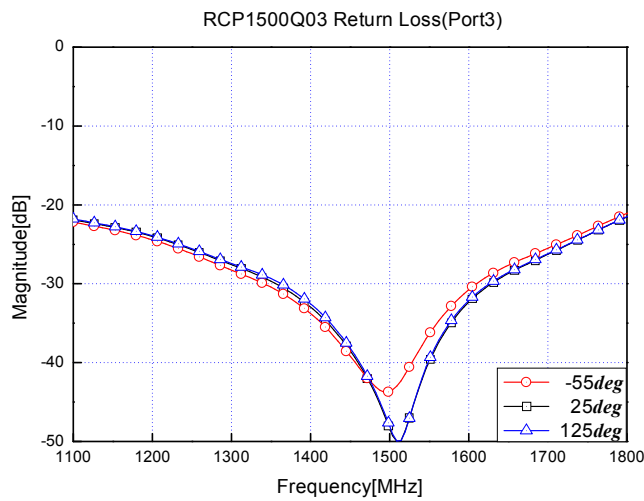
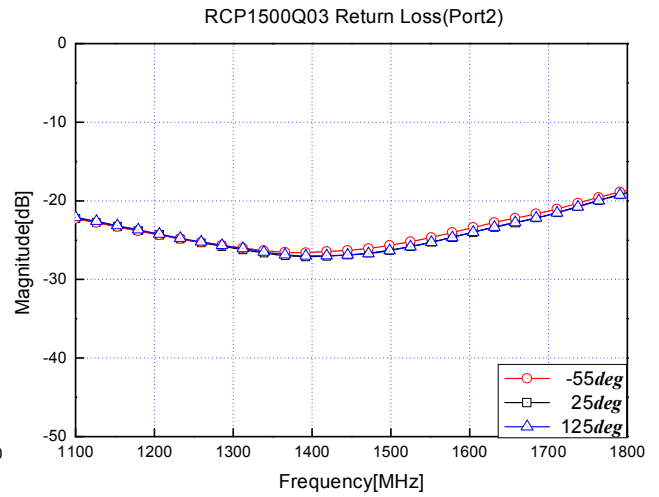
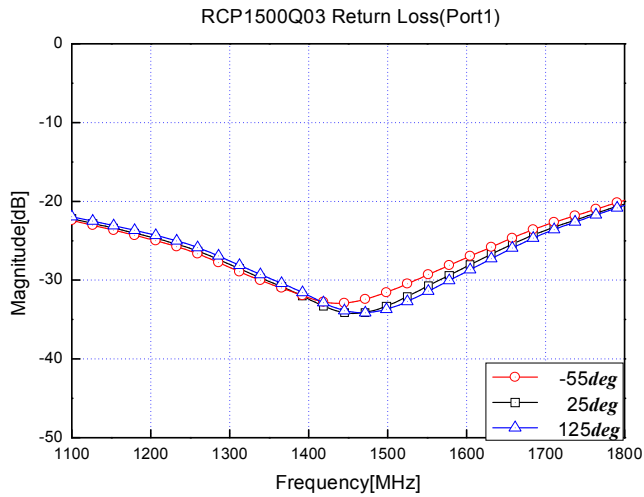


6. Typical Performance Data (25°C)

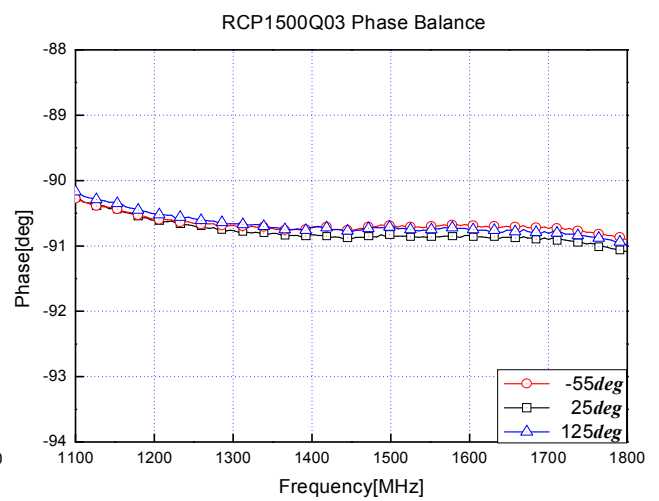
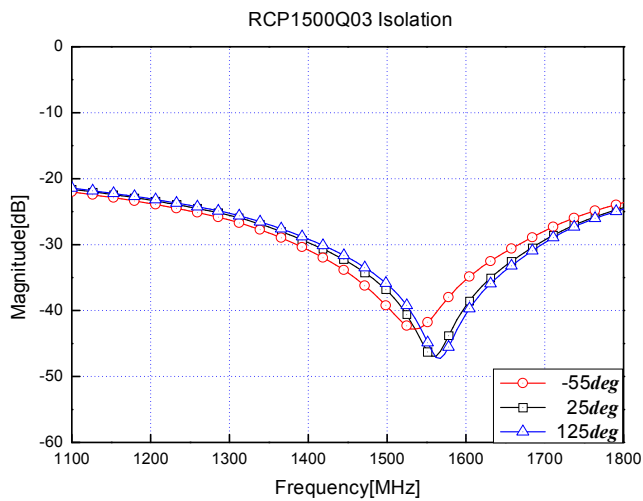
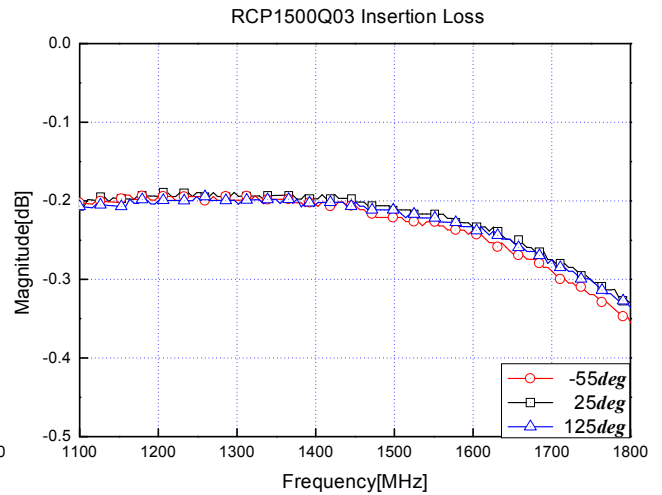
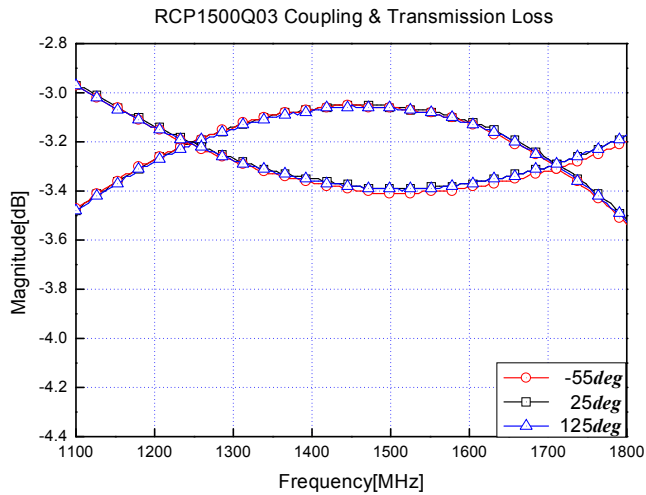
Freq. [MHz]	Coupling [dB]	Out [dB]	IL [dB]	Amp.Bal. [dB]	Phase [degree]	Return Loss [dB]			
						S11	S22	S33	S44
1100	-3.48	-2.97	-0.21	±0.26	-90.26	-21.61	-22.18	-22.21	-21.9
1125	-3.41	-3.01	-0.20	±0.20	-90.39	-22	-22.79	-22.71	-22.37
1150	-3.36	-3.06	-0.20	±0.15	-90.44	-22.42	-23.4	-23.25	-22.87
1175	-3.32	-3.09	-0.19	±0.12	-90.52	-22.78	-23.9	-23.67	-23.33
1200	-3.29	-3.12	-0.19	±0.09	-90.57	-23.07	-24.29	-24	-23.73
1225	-3.27	-3.14	-0.19	±0.06	-90.61	-23.28	-24.55	-24.21	-24.04
1250	-3.23	-3.17	-0.19	±0.03	-90.65	-23.82	-25.27	-24.74	-24.87
1275	-3.2	-3.2	-0.19	±0.00	-90.69	-24.28	-25.93	-25.14	-25.63
1300	-3.17	-3.24	-0.19	±0.03	-90.72	-24.89	-26.93	-25.6	-26.64
1325	-3.14	-3.27	-0.19	±0.06	-90.77	-25.62	-28.08	-26.03	-27.66
1350	-3.12	-3.29	-0.19	±0.09	-90.8	-26.31	-29.02	-26.39	-28.48
1375	-3.09	-3.32	-0.19	±0.12	-90.81	-27.33	-30.16	-26.78	-29.67
1400	-3.08	-3.34	-0.20	±0.13	-90.84	-28.51	-31.28	-27.04	-31.19
1425	-3.07	-3.35	-0.20	±0.14	-90.83	-29.83	-32.55	-27.08	-33.19
1450	-3.05	-3.36	-0.19	±0.16	-90.87	-30.98	-33.51	-27.01	-35.23
1475	-3.05	-3.38	-0.20	±0.17	-90.89	-32.66	-34.2	-26.85	-38.57
1500	-3.05	-3.39	-0.21	±0.17	-90.86	-34.73	-33.98	-26.59	-42.97
1525	-3.06	-3.39	-0.21	±0.17	-90.83	-36.82	-33.31	-26.28	-48.01
1550	-3.07	-3.39	-0.22	±0.16	-90.86	-40.63	-32.07	-25.8	-47.01
1575	-3.08	-3.38	-0.22	±0.15	-90.86	-46.27	-30.7	-25.25	-39.56
1600	-3.1	-3.38	-0.23	±0.14	-90.85	-43.82	-29.37	-24.62	-34.91
1625	-3.12	-3.37	-0.23	±0.13	-90.84	-39.39	-28.3	-24.11	-32.4
1650	-3.14	-3.35	-0.23	±0.11	-90.88	-35.66	-26.97	-23.49	-30.17
1675	-3.19	-3.34	-0.25	±0.07	-90.87	-33.01	-25.69	-22.9	-28.57
1700	-3.22	-3.32	-0.26	±0.05	-90.88	-31.25	-24.72	-22.44	-27.52

* Data with PCB and Connector Loss (0.89 GHz = 0.04dB)

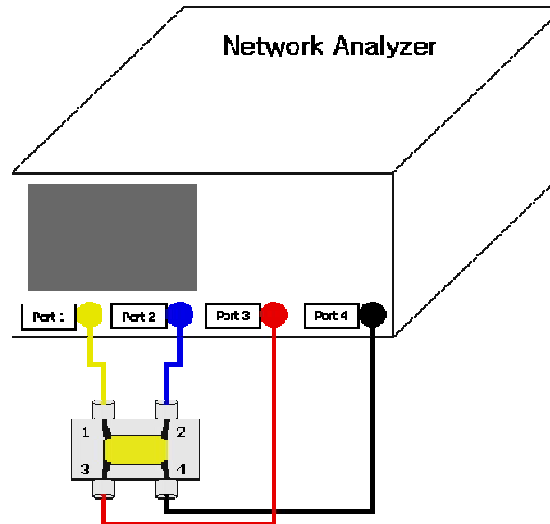
7. Operation Temperature Curve (a)



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

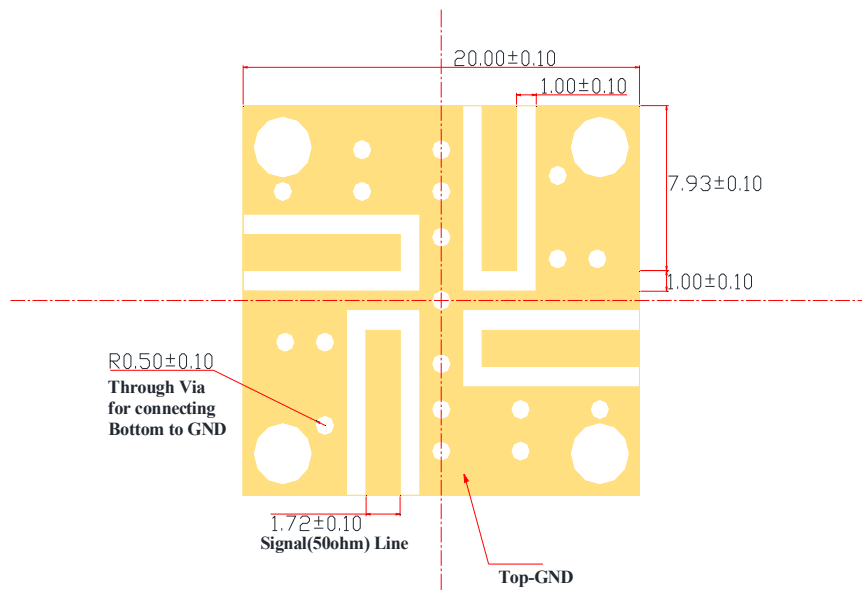
P_{out} : Power of Output Port

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	2008.06.23	New - Drawing		
	2				
	3				




NOTE. Signal line width is shown for the conditions of;

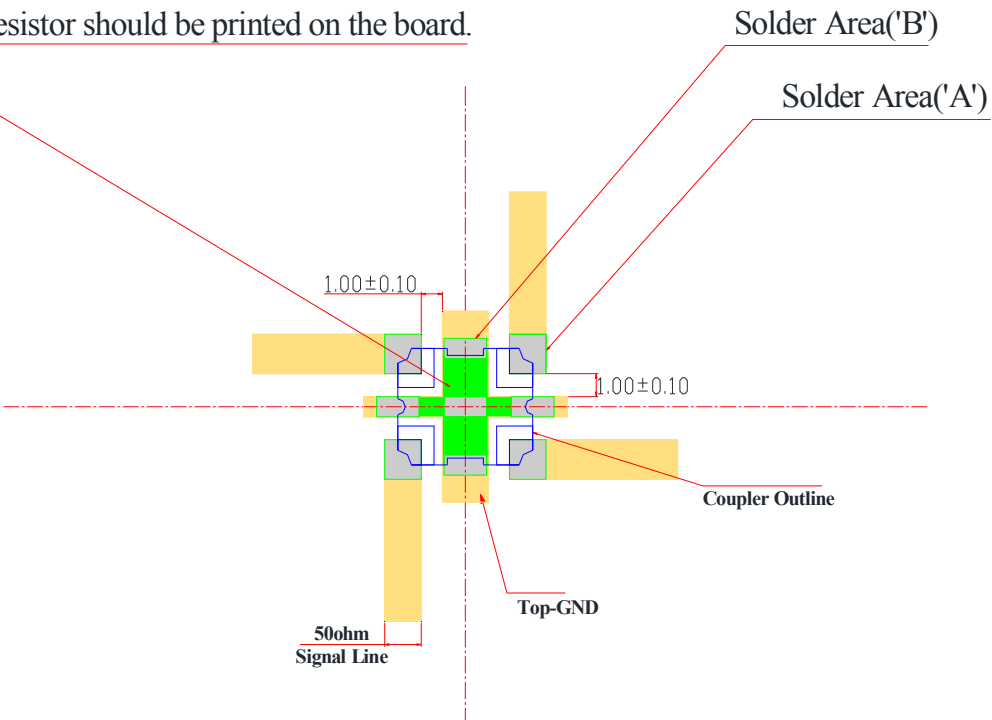
1. RF-35 (Taconic) board
2. Dielectric contance 3.5
3. Board thickness 0.8mm
4. Copper thickness 1 oz.

No.	DESCRIPTION	UNIT	TOTAL	PERUNIT	TOTAL			
		QUANTITY				SCALE		
TITLE	Q size Coupler-Measuremnet Board Outline	RN2 DWG No.	08-0623-01		SCALE			
					SIZE	A4	DIMENSION	mm

11. Recommended PCB layout and Solder mask pattern

PROJECTION	No.	DATE	REVISION & DESCRIPTION	SIGNATURE	
				REVIEWED	CHECKED
	1	2009.02.18	New - Drawing		
	2				
	3				

Attention: Solder Resistor Area
Solder Resistor should be printed on the board.

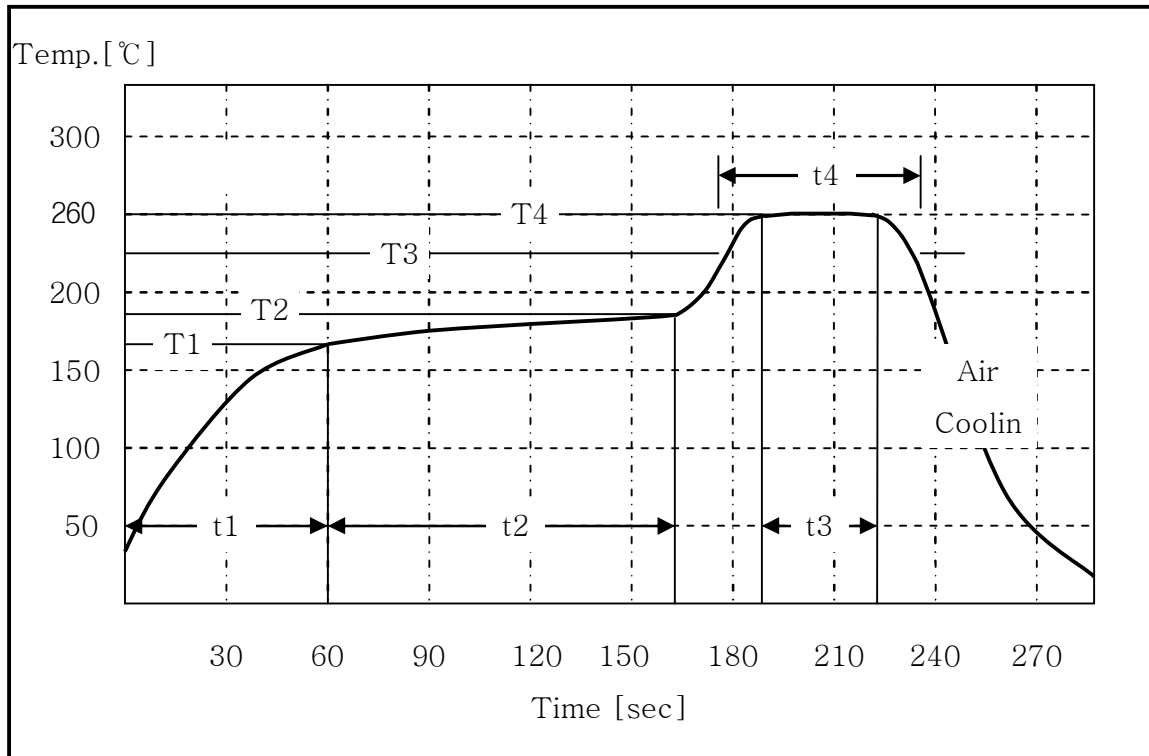


NOTE.

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 : 1.72 mm by 1.72 mm
4. Solder Area ('B') Demension : 2.0 mm by 0.88 mm

No.	DESCRIPTION	UNIT	TOTAL	PERUNIT	TOTAL		
		QUANTITY					
TITLE	Q size - Recommended Solder Quantity & Area	RN2 DWG No.	09-0218-01		SCALE		
					SIZE	A4	DIMENSION

12. Reflow profile



	Ramp Up	Pre-Heating	Peak	Soaking
Temp. [°C]	T1:160±5°C	T2:180±5°C	T4:260±5°C	T3:230±5°C
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.

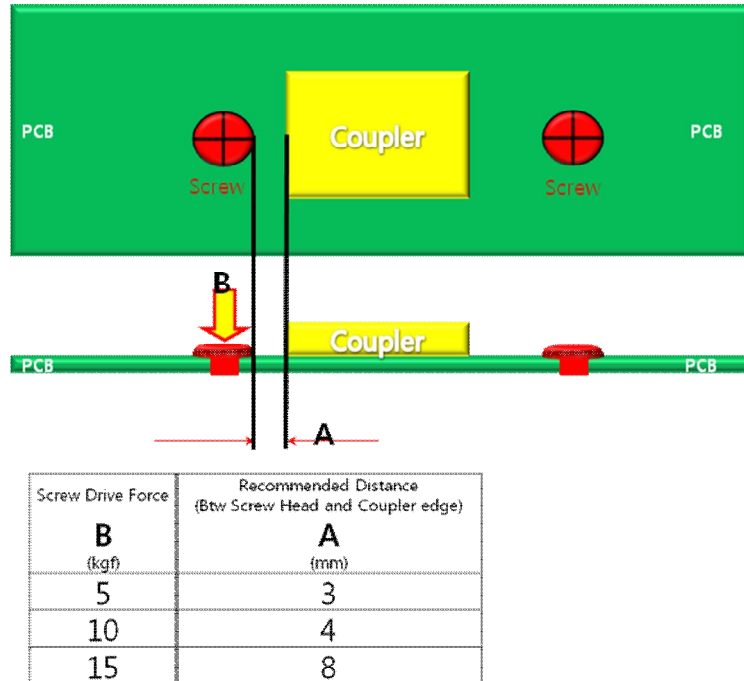
II. Be careful during storage

- A. Store the products in the temperature of $-55 \sim 125^{\circ}\text{C}$
- B. Keep the humidity at $45 \sim 75\%$ 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

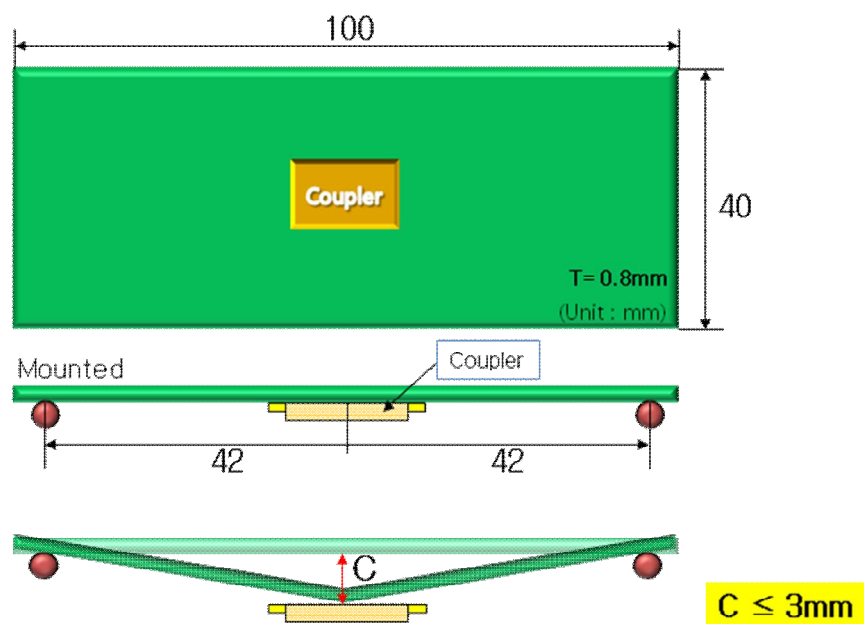
- A. All the ground terminals, IN and OUT pad of coupler should be soldered on the ground plane of the PCB.
- B. Products may be cracked or broken by uneven forces from a claw or suction device.
- C. Mechanical stress by any other devices may damage products when positioning them on PCB.
- D. A dropped 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.

IV. Be careful when Screw

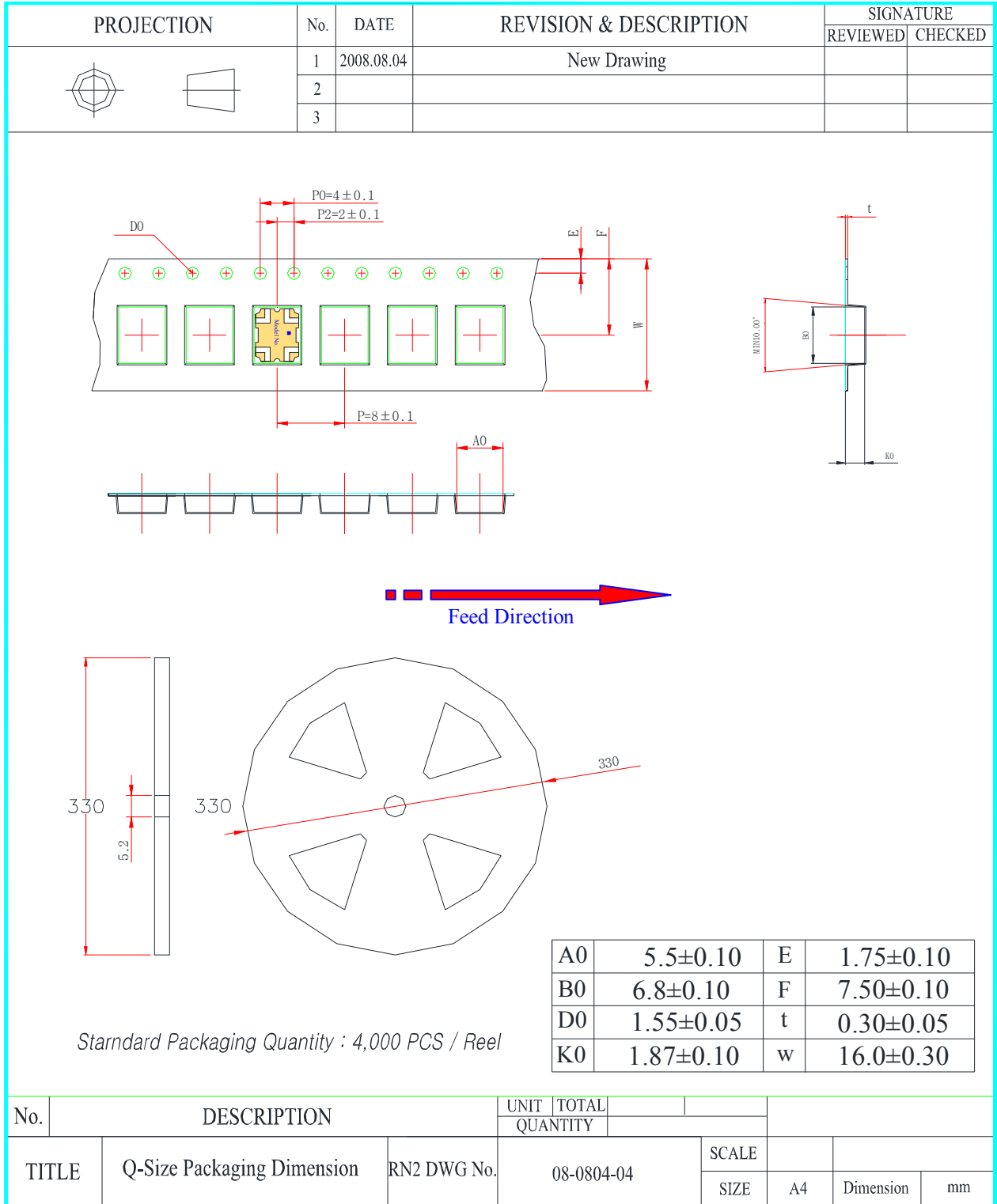


V. Be careful when SMD or Assembly

- A. LTCC couplers require appropriate measures to avoid its base PCB from warping.
- B. PCB excessively warping over defined standard may result in crack of LTCC couplers potentially.



14. Packaging



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, 2008

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

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