

Specification

For

LTCC 20dB Directional Coupler

Model Name : RCP3500Q20

Customer :

Title:

Name :

APPROVED

By Date : _____

Signature : _____

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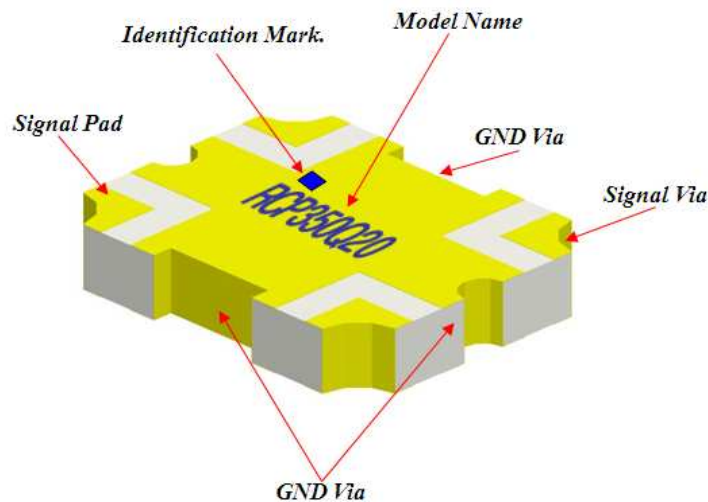
Issued Date : _____

Designed : _____

Approved : _____

1. Description

1-1. Part number: RCP3500Q20(Denoted marking:RCP350Q20)



1-2. Features


- Directional Coupler 20dB
- Surface mount type
- Suitable for operation frequency 3400~3600MHz
- **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

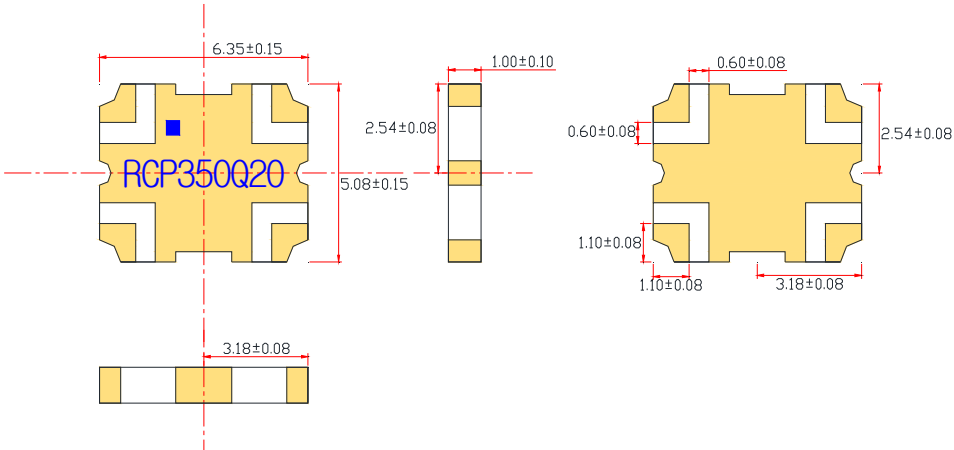
2. Electrical Specification

Freq. (MHz)	Coupling (dB)	Directivity Max (dB)	Insertion Loss min (dB)
3400-3600	20 ± 1	-20	-0.22
VSWR	Power Capacity	Characteristic Imp.	Operating Temp.
Max	Avg. (Watt)	(ohm)	(°C)
1.2	80	50	-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				



Technical drawing of the RCP350Q20 component. The drawing includes three views: a top view, a side view, and a bottom view. The top view shows a square-like shape with rounded corners and four mounting tabs. Dimensions include: overall width 6.35±0.15, overall height 5.08±0.15, mounting tab width 1.00±0.10, mounting tab height 2.54±0.08, central square width 0.60±0.08, central square height 0.60±0.08, mounting tab inner width 1.10±0.08, mounting tab inner height 1.10±0.08, and mounting tab outer width 3.18±0.08. The side view shows a thickness of 1.00±0.10. The bottom view shows a width of 3.18±0.08. The part number RCP350Q20 is marked on the top view.

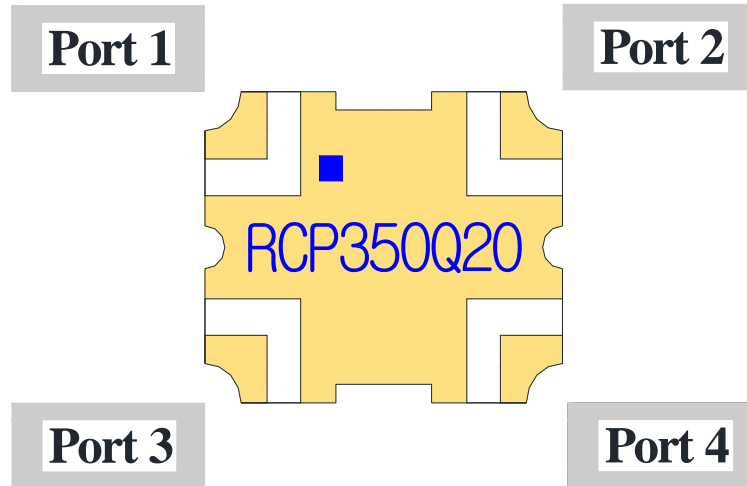
Note.
1. SMD-type, Ceramic Base.
2. Inner signal circuits : Silver(Ag) conductor
3. Surface plating : Gold(Au) finished
4. Tolerance is not cumulative.

NO.	DESCRIPTION	UNIT	TOTAL		
		QUANTITY			
TITLE	RCP350Q20-Outline	RN2 DWG NO.	08-1020-01	SCALE	
				SIZE	A4
				DIMENSION	mm

3-2. Weight

- $0.09 \pm 10\%$ Grams typical

4. Port Configuration



Configuration	Port 1	Port 2	Port 3	Port 4
Case 1.	Input	Output	Coupled	Isolated
Case 2.	Output	Input	Isolated	Coupled
Case 3.	Coupled	Isolated	Input	Output
Case 4.	Isolated	Coupled	Output	Input

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

5. Schematic Drawing

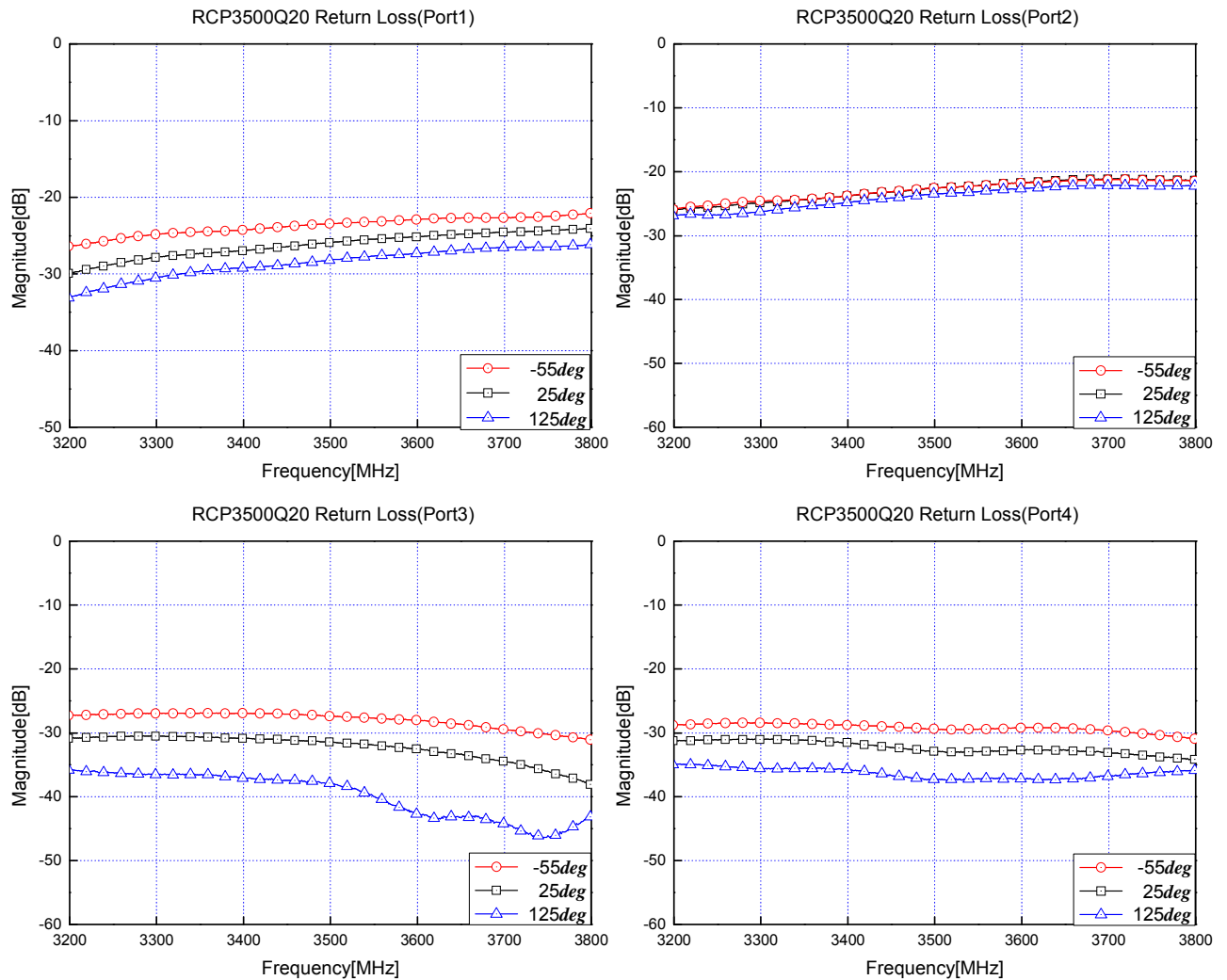


6. Typical Performance Data (25℃)

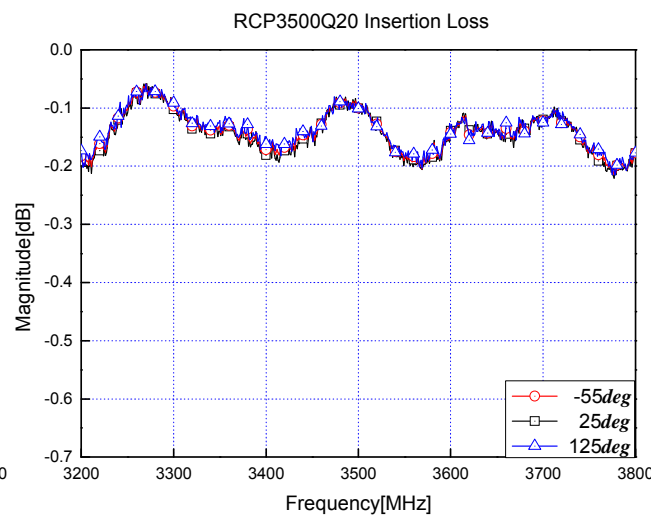
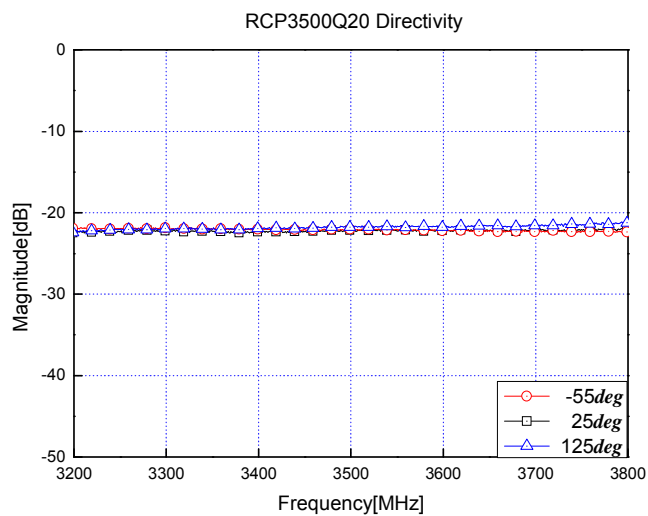
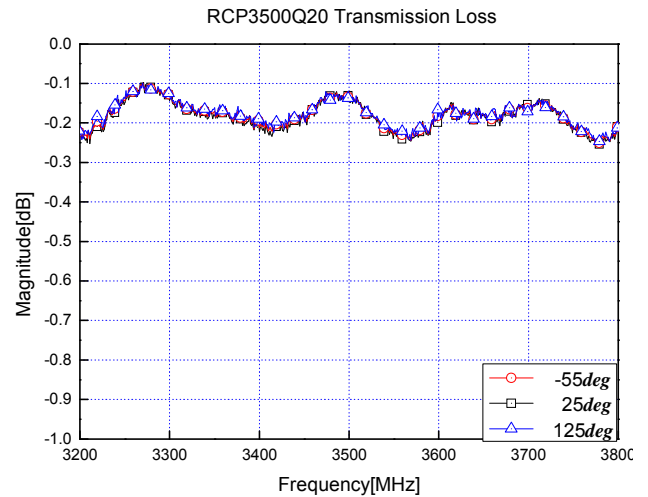
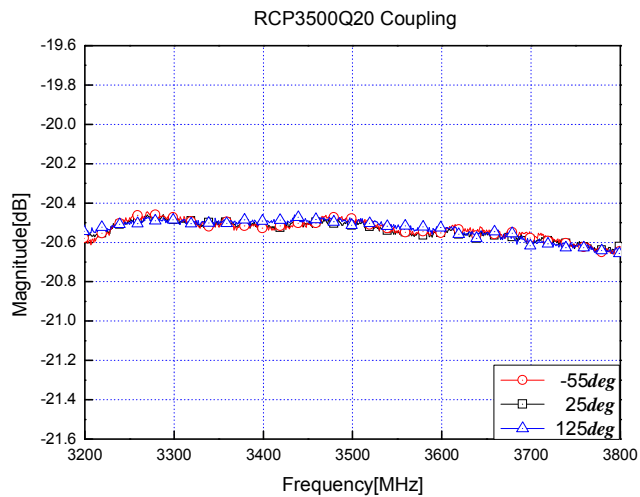
Freq. [MHz]	Coupling [dB]	Out [dB]	IL [dB]	Directivity [dB]	Return Loss [dB]			
					S11	S22	S33	S44
3400	-20.52	-0.22	-0.18	-22.39	-26.94	-23.77	-30.89	-31.57
3410	-20.52	-0.23	-0.19	-22.40	-26.84	-23.63	-30.93	-31.72
3420	-20.51	-0.21	-0.17	-22.27	-26.77	-23.45	-30.99	-31.84
3430	-20.51	-0.21	-0.17	-22.46	-26.66	-23.36	-30.99	-31.97
3440	-20.51	-0.19	-0.15	-22.33	-26.53	-23.27	-31.10	-32.15
3450	-20.51	-0.19	-0.15	-22.32	-26.43	-23.16	-31.13	-32.29
3460	-20.52	-0.17	-0.13	-22.20	-26.32	-23.09	-31.17	-32.46
3470	-20.48	-0.14	-0.10	-22.23	-26.20	-22.97	-31.23	-32.58
3480	-20.50	-0.13	-0.09	-22.34	-26.10	-22.81	-31.30	-32.70
3490	-20.51	-0.13	-0.09	-22.20	-26.01	-22.67	-31.41	-32.85
3500	-20.52	-0.14	-0.10	-22.16	-25.89	-22.59	-31.44	-32.90
3510	-20.50	-0.14	-0.10	-22.15	-25.80	-22.50	-31.59	-32.97
3520	-20.53	-0.16	-0.12	-22.29	-25.69	-22.40	-31.60	-32.98
3530	-20.54	-0.19	-0.15	-22.06	-25.63	-22.37	-31.68	-32.94
3540	-20.54	-0.21	-0.17	-22.17	-25.53	-22.25	-31.77	-33.00
3550	-20.55	-0.23	-0.19	-22.24	-25.47	-22.16	-31.92	-32.96
3560	-20.56	-0.23	-0.19	-22.13	-25.40	-22.07	-31.96	-32.89
3570	-20.56	-0.24	-0.20	-22.18	-25.33	-21.94	-32.13	-32.88
3580	-20.55	-0.22	-0.18	-22.22	-25.26	-21.84	-32.29	-32.73
3590	-20.56	-0.23	-0.19	-22.19	-25.19	-21.75	-32.45	-32.72
3600	-20.54	-0.18	-0.14	-22.20	-25.14	-21.69	-32.59	-32.71

* Data with PCB and Connector Loss (3.5 GHz = 0.1dB)

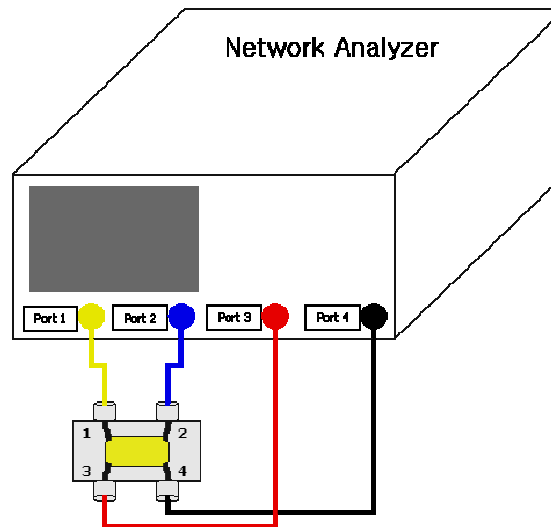
7. Operation Temperature Curve (a)



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 2. (S21)
- Measure the data of **Isolation** through port 1 to port 4. (S41)
- 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	S21	$10 \cdot \log\left(\frac{P_{out}}{P_{in}}\right)$
Isolation	S41	$10 \cdot \log\left(\frac{P_{iso}}{P_{in}}\right)$
Insertion Loss		$10 \cdot \log\left(\frac{P_{in}}{P_{cou} + P_{out}}\right)$
Directivity		$10 \cdot \log\left(\frac{P_{cou}}{P_{iso}}\right)$

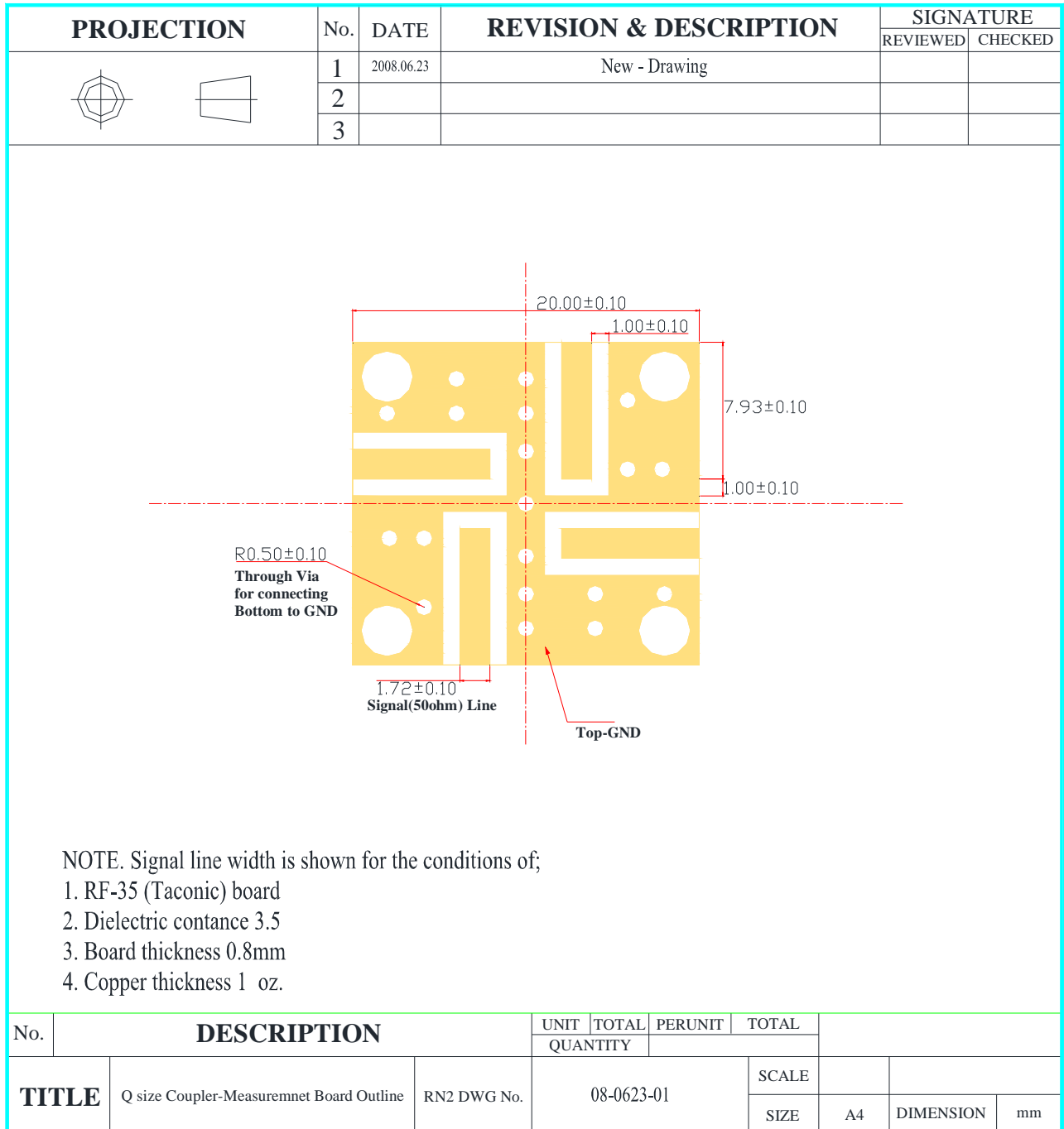
P_{in} : Power of Input Port

P_{out} : Power of Output Port


P_{cou} : Power of Coupling Port

P_{iso} : Power of Isolated Port

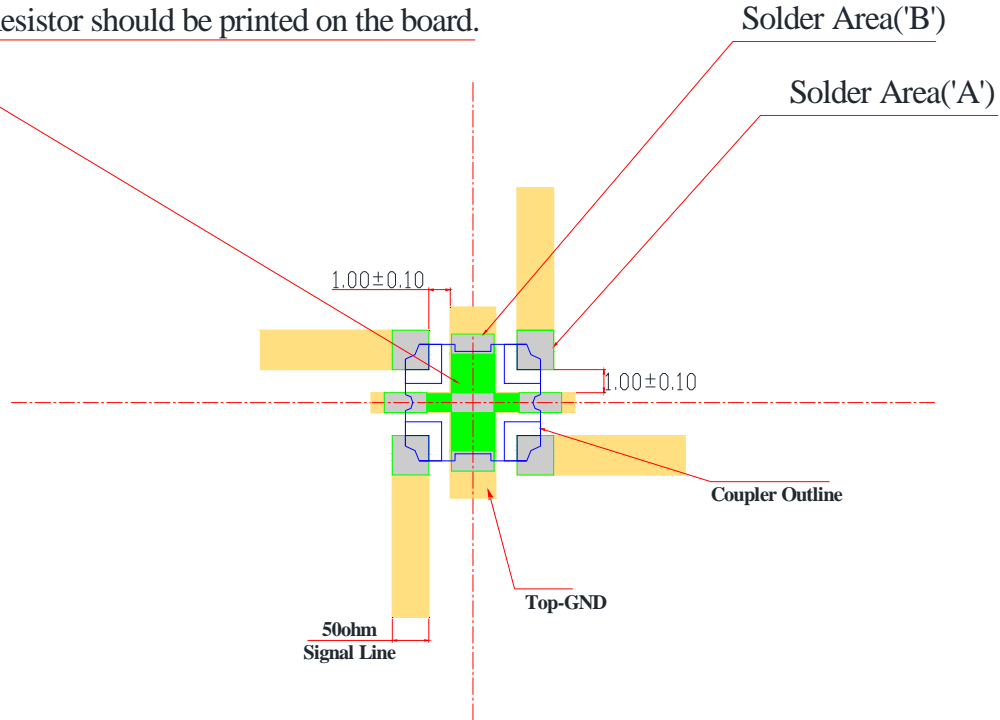
10. Measurement board layout



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.

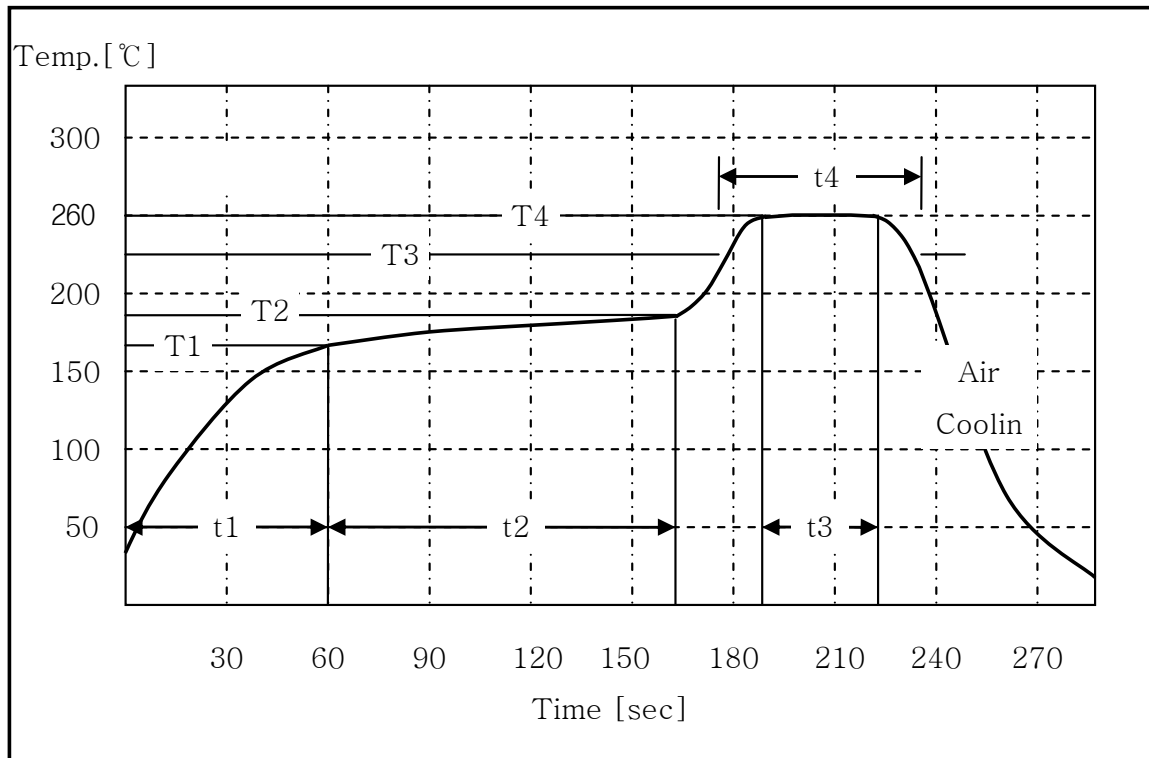


NOTE.

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') Dimension : 1.72 mm by 1.72 mm
4. Solder Area ('B') Dimension : 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	A4	DIMENSION mm	
						SIZE	

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.

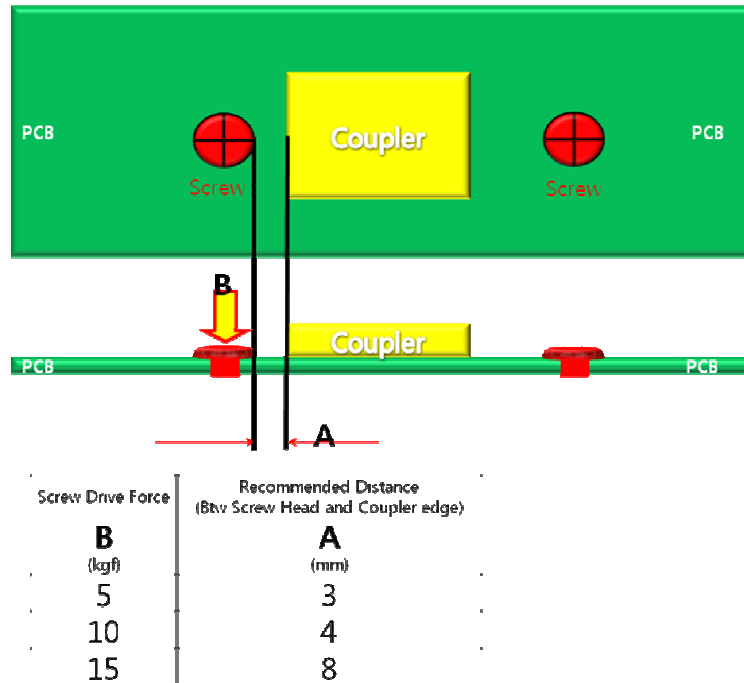
II. Be careful during storage

- A. Store the products in the temperature of -55 ~ 125 °C
- B. Keep the humidity at 45 ~ 75% around the products.
- C. Prevent corrosive gas (Cl₂, NH₃, 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

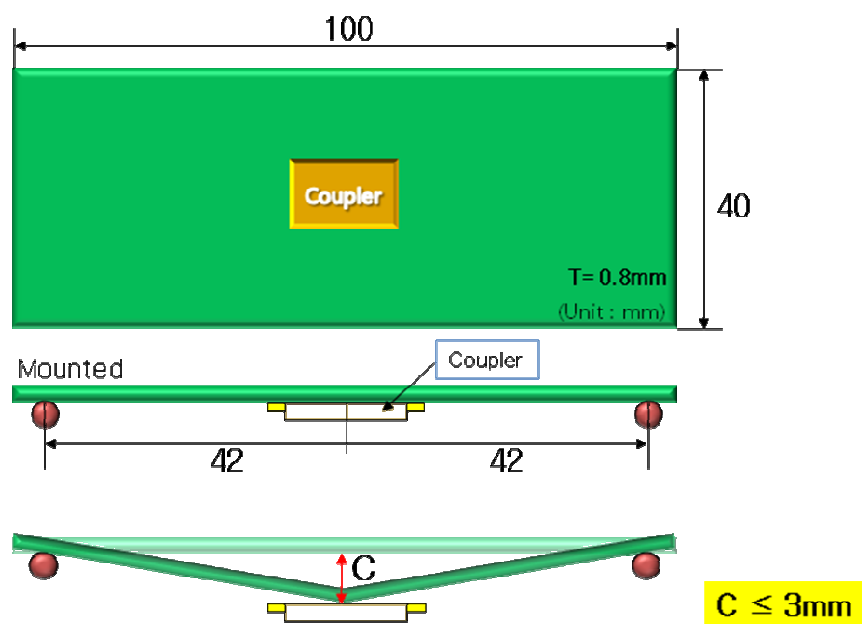
- A. All the ground terminals, IN and OUT pad of coupler should be soldered on the ground plane of the PCB.
- B. Products may be cracked or broken by uneven forces from a claw or suction device.
- C. Mechanical stress by any other devices may damage products when positioning them on PCB.
- D. A dropped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

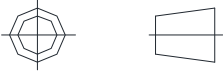


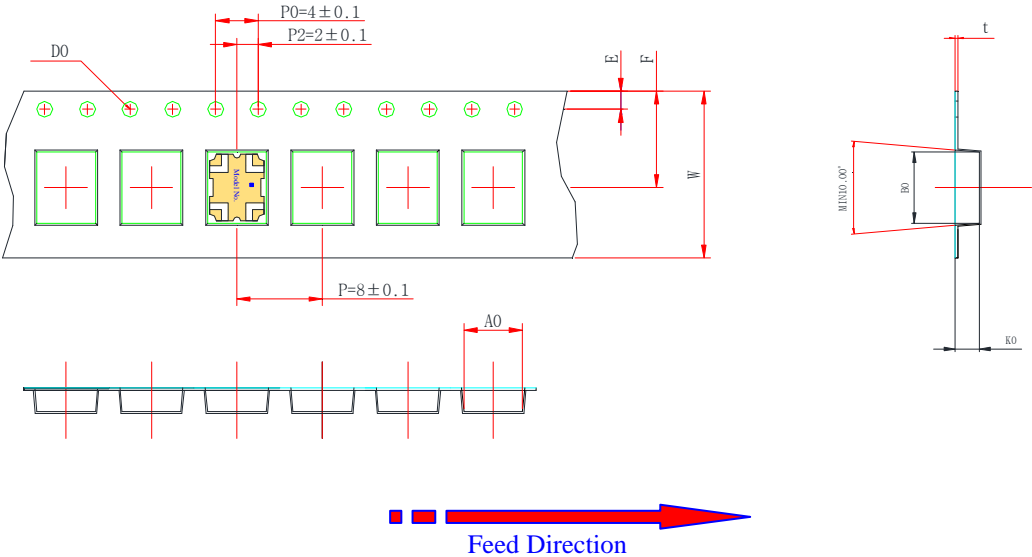
V. Be careful when SMD or Assembly

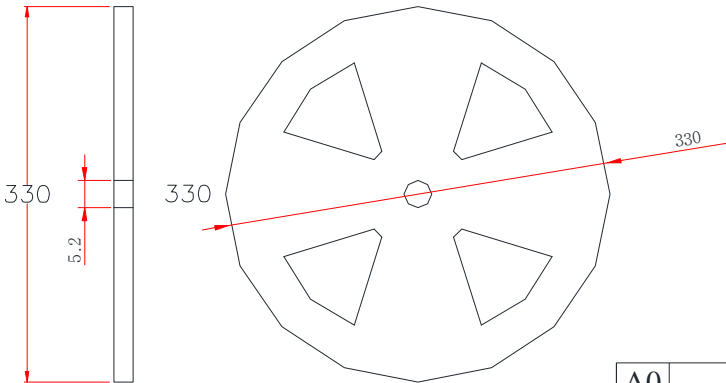
- A. LTCC couplers require appropriate measures to avoid its base PCB from warping.
- B. PCB excessively warping over defined standard may result in crack of LTCC couplers potentially.



14. Packaging

PROJECTION	No.	DATE	REVISION & DESCRIPTION	SIGNATURE	
				REVIEWED	CHECKED
	1	2008.08.04	New Drawing		
	2				
	3				





A0	5.5±0.10	E	1.75±0.10
B0	6.8±0.10	F	7.50±0.10
D0	1.55±0.05	t	0.30±0.05
K0	1.87±0.10	w	16.0±0.30

Standard Packaging Quantity : 4,000 PCS / Reel

No.	DESCRIPTION		UNIT	TOTAL			
			QUANTITY				
TITLE	Q-Size Packaging Dimension	RN2 DWG No.	08-0804-04	SCALE			
				SIZE	A4	Dimension	mm

15. Environmental Reliability

ITEM	PROCEDURE	REQUIREMENTS/RESULT
Temperature Cycle (Thermal Shock)	1. One Cycle : 30 min Step1: $125 \pm 5^{\circ}\text{C}$ for 15 min Step2: $-55 \pm 5^{\circ}\text{C}$ 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 : $230 \pm 5^{\circ}\text{C}$ for 5 ± 1 sec.	1. More than 85% of the I/O electrode pad shall be covered with solder.
Heat Resistance	1. Temperature : $100 \pm 2^{\circ}\text{C}$ 2. Duration : 96 ± 2 hours	1. Meet the electrical Specification after test
Low Temp. Resistance	1. Temperature : $-55 \pm 5^{\circ}\text{C}$ 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 $-25 \sim 65^{\circ}\text{C}$ 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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