

Specification
For
LTCC 3dB Hybrid Coupler

Model Name : RCP200B03

Customer :

Title:

Name :

APPROVED

By Date : _____

Signature : _____

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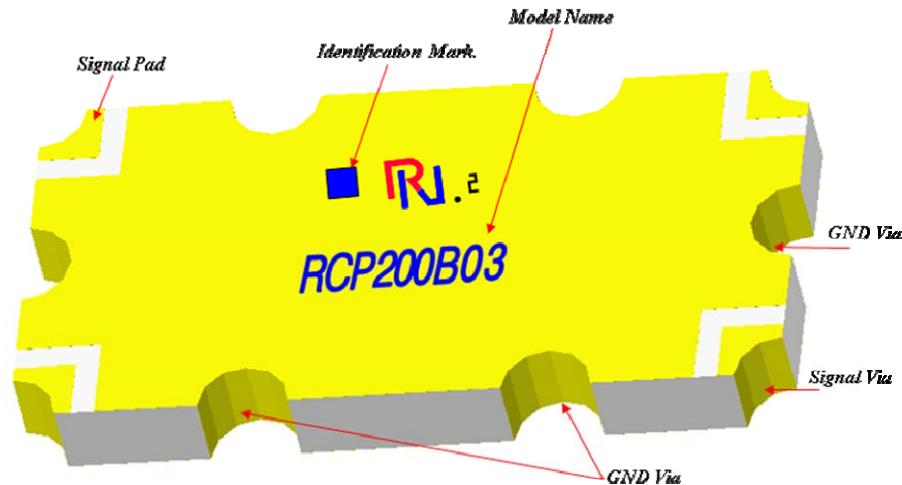
Issued Date : _____

Designed : _____

Approved : _____

1. Description

1-1. Part number: RCP200B03



1-2. Features

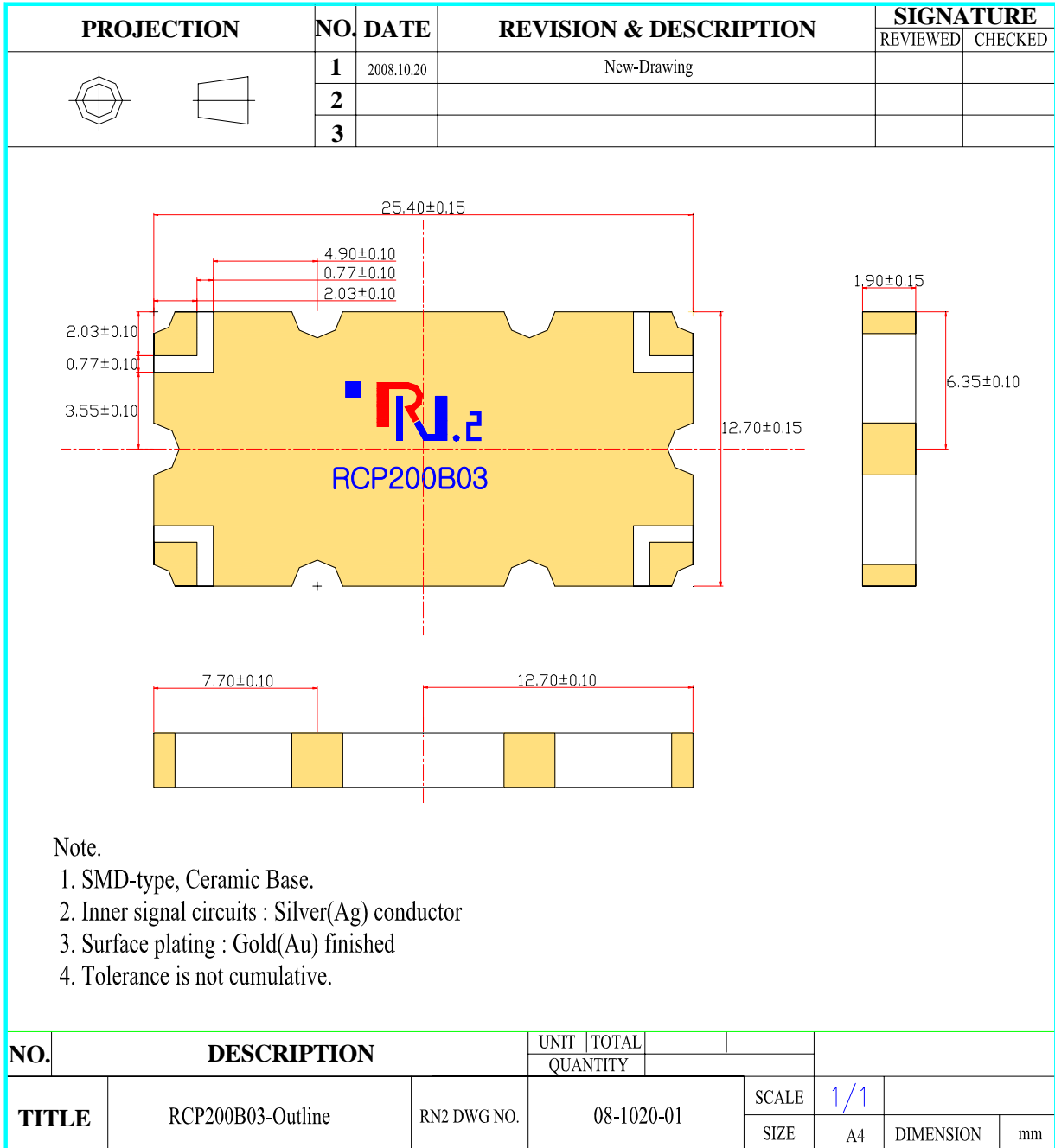
- Hybrid Coupler 3dB, 90°
- Surface mount type
- Suitable for operation frequency 180~210MHz
- **RoHS** compliance
- High stability in temperature and humidity for LTCC base
- Low loss for Silver(Ag) conductor
- Miniature size and high power capability
- Lead-free alloy solderable
- Thermal expansion corresponding with common substrate

2. Electrical Specification

Freq. (MHz)	Amplitude Balance max (dB)	Isolation min (dB)	Insertion Loss max (dB)
180-210	± 0.30	-20	-0.3
VSWR Max	Phase (degrees)	Power Capacity Avg. (Watt)	Operating Temp. (°C)
1.2	90 ± 3.0	200	-55 to +125

3. Mechanical Specification

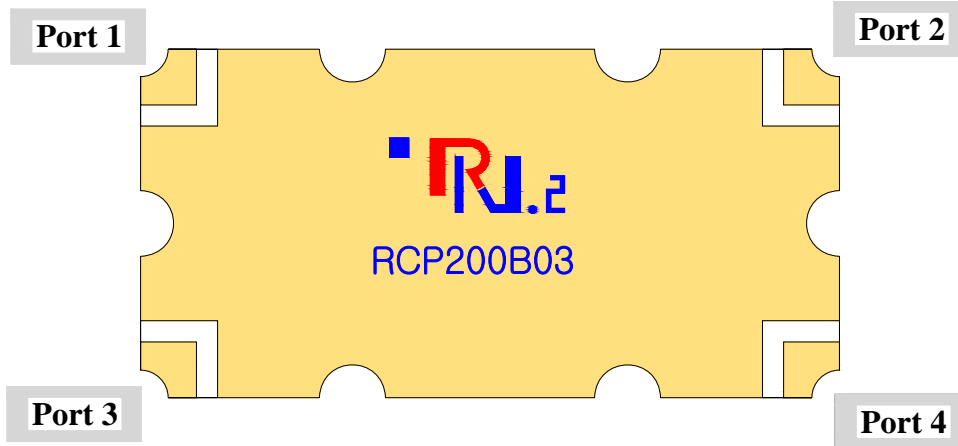
3-1. Outline Dimension



3-2. Weight

- 2.45 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.

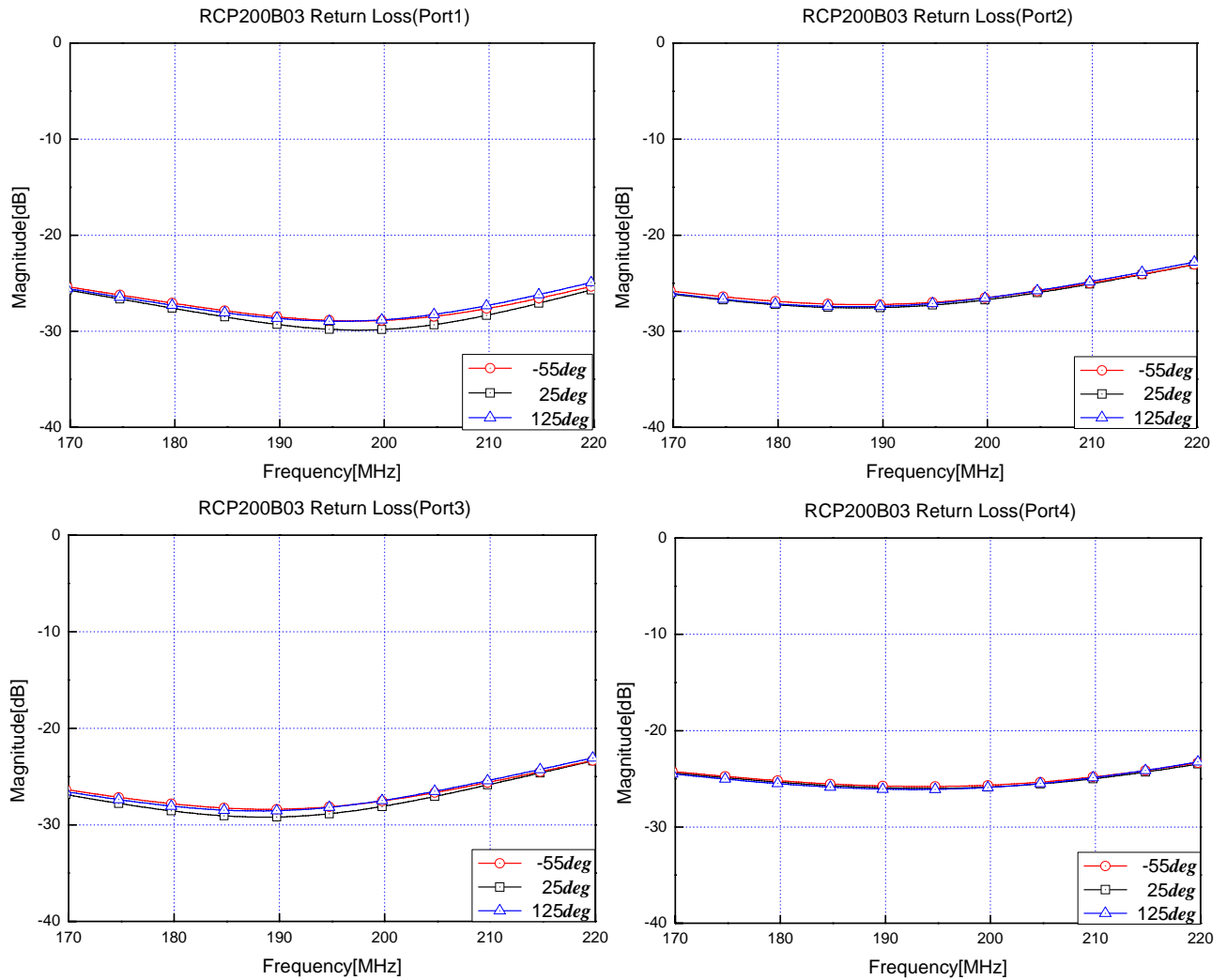
5. Schematic Drawing



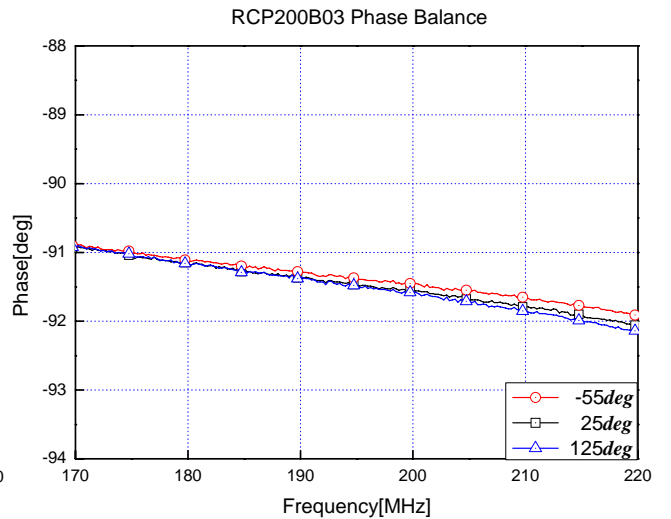
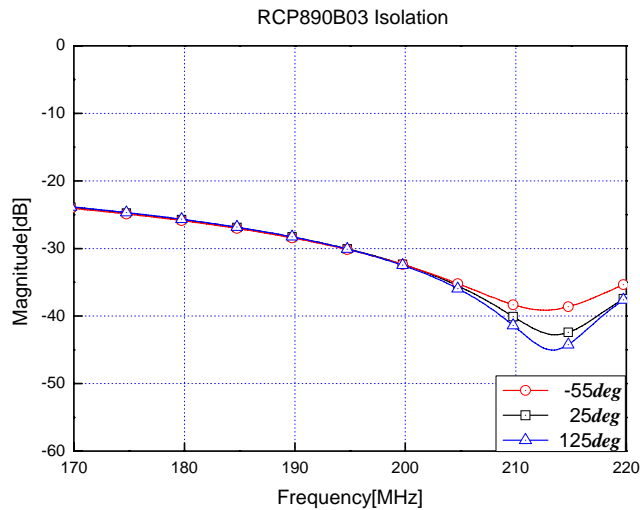
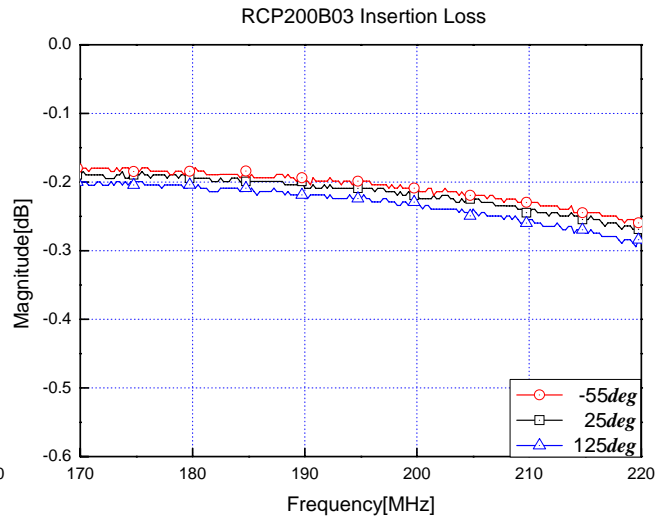
6. Typical Performance Data (25 °C)

Freq. [MHz]	Coupling [dB]	Out [dB]	IL [dB]	Amp.Bal. [dB]	Phase [degree]	Return Loss [dB]			
						S11	S22	S33	S44
180	-3.15	-3.26	-0.1944	±0.055	-91.16	-27.11	-26.9	-27.84	-25.36
182	-3.15	-3.27	-0.1993	±0.06	-91.19	-27.43	-27.03	-28.05	-25.51
184	-3.14	-3.27	-0.1942	±0.065	-91.23	-28.07	-27.49	-29.01	-25.65
186	-3.14	-3.28	-0.1991	±0.07	-91.3	-28.03	-27.19	-28.33	-25.77
188	-3.14	-3.28	-0.1991	±0.07	-91.31	-28.29	-27.22	-28.39	-25.86
190	-3.15	-3.29	-0.2091	±0.07	-91.36	-28.52	-27.2	-28.38	-25.93
192	-3.15	-3.29	-0.2091	±0.07	-91.41	-28.71	-27.14	-28.32	-25.98
194	-3.15	-3.29	-0.2091	±0.07	-91.45	-28.84	-27.04	-28.2	-25.99
196	-3.15	-3.29	-0.2091	±0.07	-91.49	-28.91	-26.89	-28.02	-25.97
198	-3.16	-3.29	-0.2142	±0.065	-91.53	-28.92	-26.71	-27.78	-25.93
200	-3.17	-3.29	-0.2193	±0.06	-91.56	-28.87	-26.49	-27.49	-25.85
202	-3.19	-3.28	-0.2245	±0.045	-91.61	-28.75	-26.24	-27.17	-25.74
204	-3.19	-3.28	-0.2245	±0.045	-91.65	-28.54	-25.95	-26.81	-25.59
206	-3.21	-3.27	-0.2296	±0.03	-91.7	-28.29	-25.64	-26.42	-25.41
208	-3.23	-3.26	-0.2347	±0.015	-91.74	-27.97	-25.3	-26	-25.2
210	-3.25	-3.26	-0.2447	±0.005	-91.78	-27.6	-24.95	-25.57	-24.97

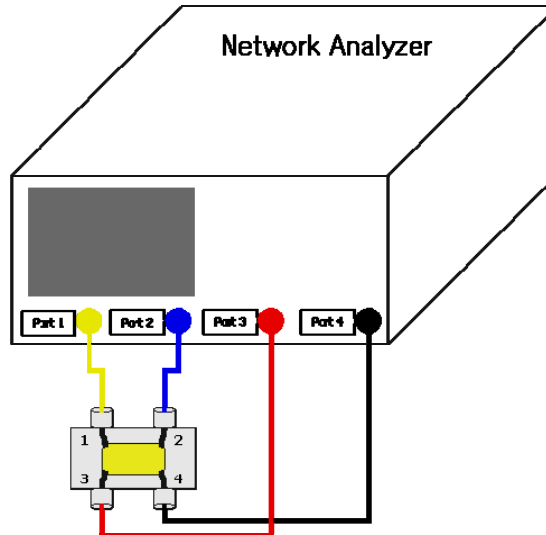
7. Operation Temperature Curve (a)



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	Phase _(S31) — Phase _(S41)	

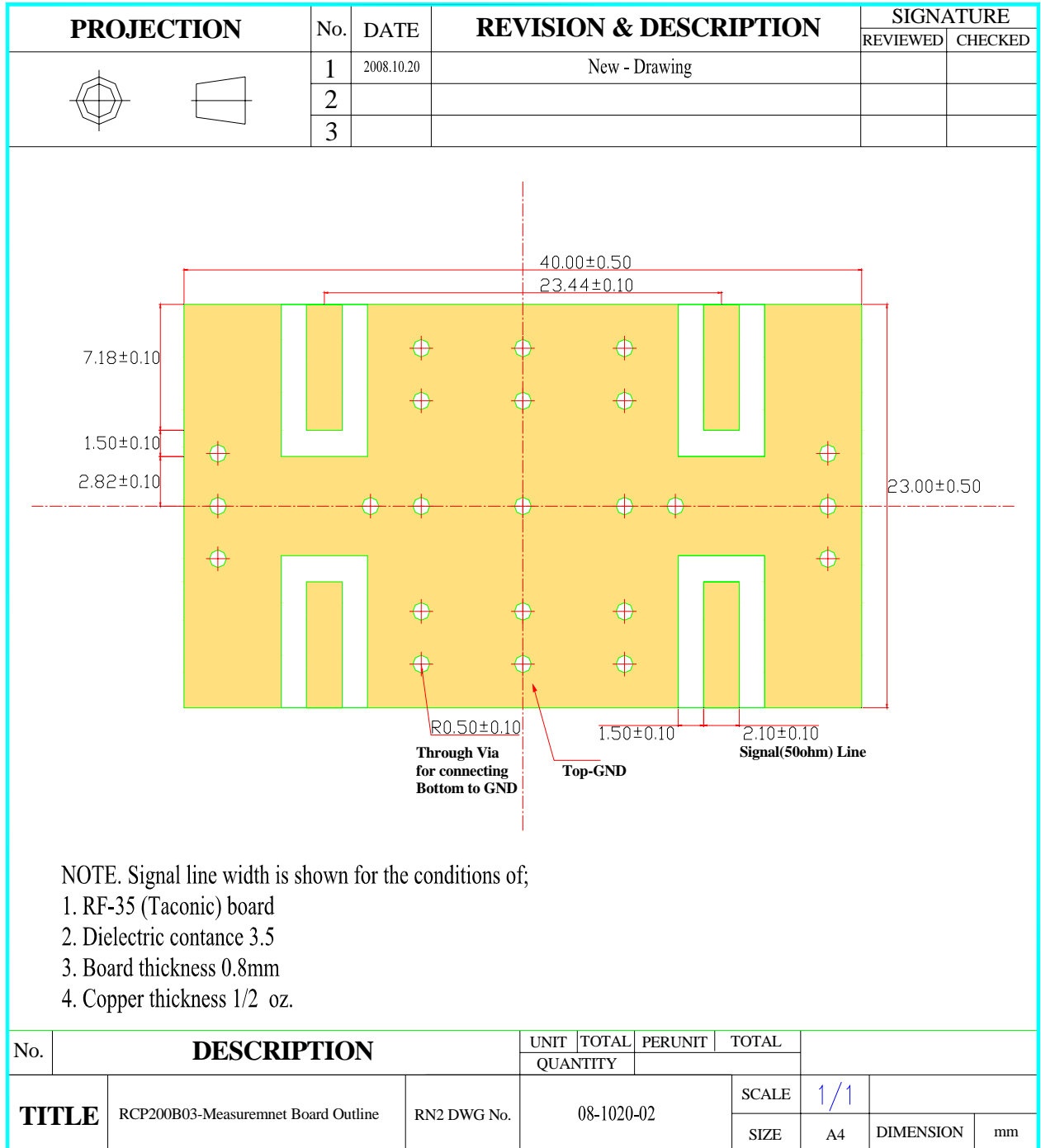
P_{in} : Power of Input Port

P_{out} : Power of Output Port

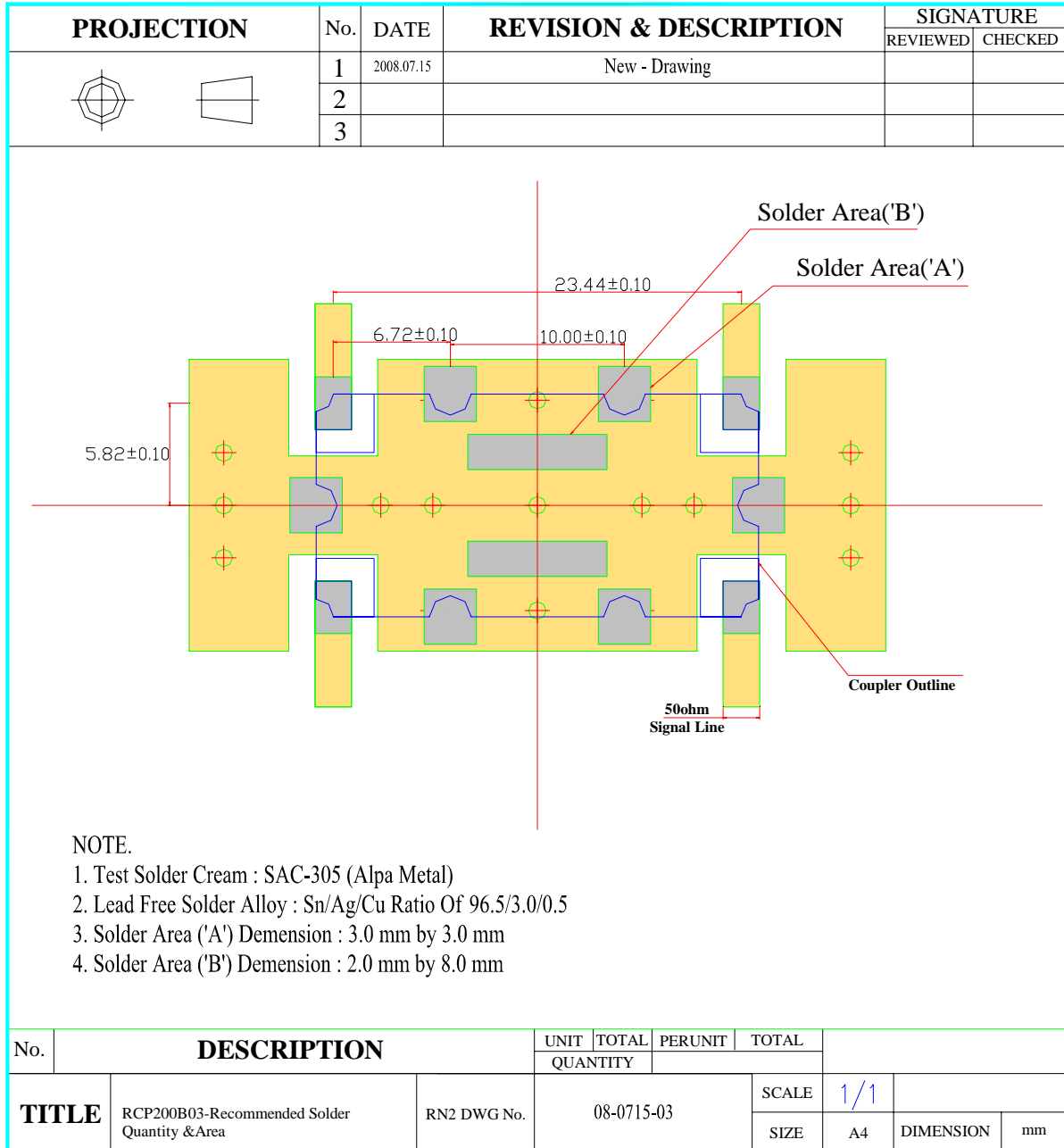
P_{cou} : Power of Coupling Port

P_{iso} : Power of Isolated Port

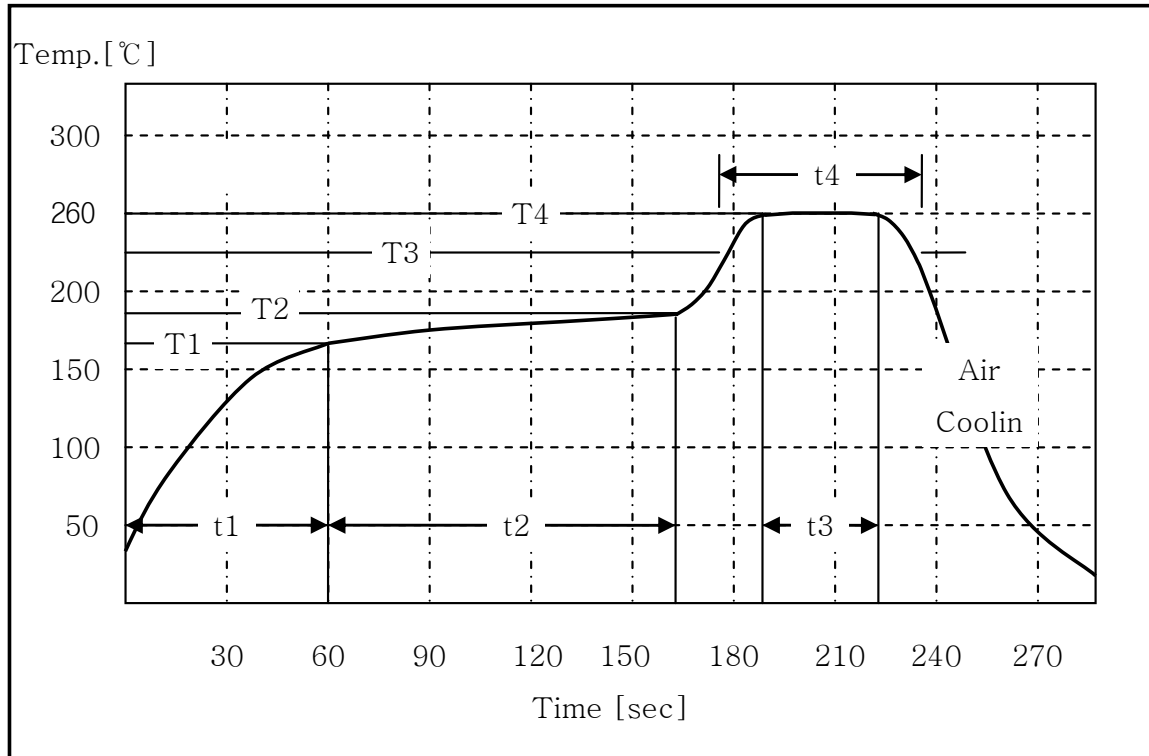
10. Measurement board layout



11. Recommended PCB layout and Solder mask pattern



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.

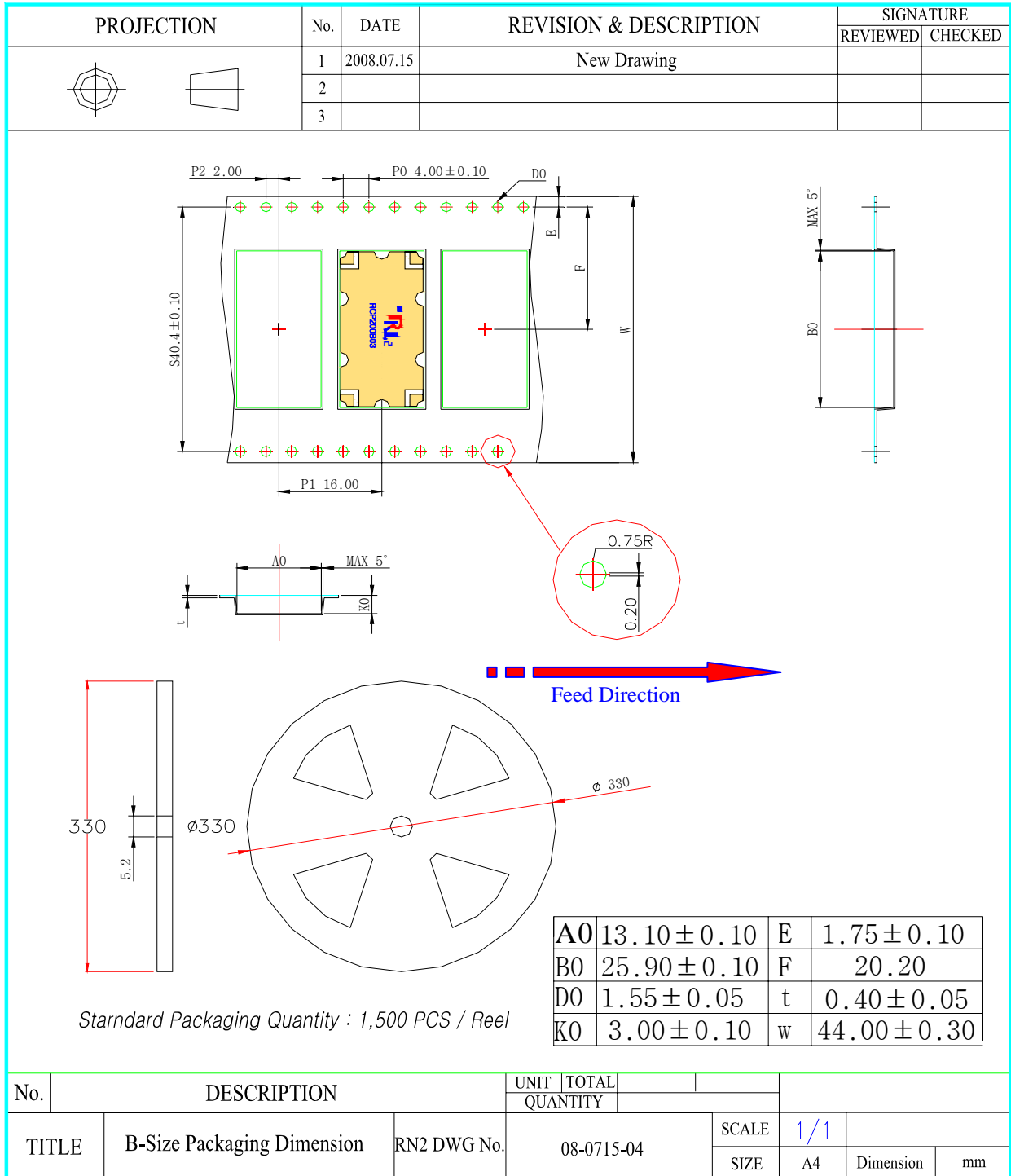
II. Be careful during storage

- 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.

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 $-25 \sim 65$ °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

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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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