Serial No. : 2014-0217B
DATE : 2014/06/27

LG Electronics Inc.

ITEM : CRYSTAL RESONATOR

TYPE :	DSR221STH
NOMINAL FREQUENCY :	26.000MHz
SPEC No. :	1RAB26000AEA
USER PART No. :	EAW62443401

"RoHS Product"

Please acknowledge receipt of this specification by signing and returning a copy to us.

RECEIPT	
DATE	
RECEIVED	(signature) (name)

LGE	Approved Gr.	부품개발	부품개발	
	Approved by	이병석	임재상	
	Signature	이병석		

General Manufacturer of Quartz Devices

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C.ENG. A. Hishikawa

ENG. H. Takase

DSR221STH TYPE SPECIFICATION

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Country	Spec No.
THAILAND	1RAB26000AEA

Device Name Crystal Resonator (with dedicated temperature sensor)
Model Name DSR221STH
Nominal Frequency 26.000 MHz
Mass 0.02g max.
Absolute Maximum Ratings

Item	Rating	unit
Storage Temperature Range	-40~85	°C

Recommended Operating Conditions

Item	min.	typ.	max.	unit
Operating Temperature Range	-30	-	85	°C

1. ELECTRICAL CHARACTERISTICS

Crystal Resonator

(This test shall be performed under the conditions of temp.at 25 ± 3°C, Relative Humidity 60% max.)

	Item	Limits			unit	Conditions	Notes
		min.	typ.	max.			
1	Mode of Vibration	-	AT-cut Fundamental	-			
2	Initial Frequency Tolerance	-	-	±10	ppm	T_A=+25°C	
3	Tolerance Over Temperature	-	-	±10	ppm	T_A= -25~85°C	*1
4	Equivalent Series Resistance	-	-	30	Ω		
5	Spurious Mode Series Resistance	500	-	-	Ω	±1MHz	
6	G Sensitivity	-	-	±2	ppb/G		
7	Full Cycle Temperature Hysteresis	-	-	±0.5	ppm	T_A= -40~85°C	*2
8	Small Cycle Temperature Hysteresis	-	-	±0.05	ppm		*3
9	Load Capacitance	-	7	-	pF		
10	Tuning Sensitivity	25.2	-	30.8	ppm/pF		
11	Insulation Resistance	500	-	-	MΩ		
12	Drive Level	-	-	100	uW		
13	Perturbation	-	-	±0.5	ppm		*4
14	Aging	-	-	±1.0	ppm/year		
		-	-	±1.5	ppm/2years		
		-	-	±2.5	ppm/5years		
		-	-	±5.0	ppm/10years		
15	First-order Curve Fitting Parameter/ C1	-0.1	-0.225	-0.35			*5
16	Second-order Curve Fitting Parameter/ C2	-0.0005	-0.00085	-0.0012			*5
17	Third-order Curve Fitting Parameter/ C3	0.000087	0.000099	0.00011			*5
18	Frequency Stability Slope	-	-	±0.05	ppm	T_A= -10~60°C	*6
		-	-	±0.5	ppm	T_A= -30~85°C	
19	Drive Level Dependency						
	1. FDLD	-	-	3	ppm		*7
	2. Frequency (Repeatability)	-	-	0.7	ppm		*7
	3. DLD2	-	-	5	Ω		*7
	4. ESR(Repeatability)	-	-	10	%		*7

Notes

*1. Refer to the value at +25°C

*2. Difference in freq. measurement at any temperature when undergoing a thermal cycle over the entire operation temperature range from -40°C to 85°C per 2°C test

*3. Difference in freq. measurement at any temperature when undergoing a thermal cycle of a temperature range of 5°C per 1°C test

*4. Residual error from the freq. vs. temperature curve fit 5th order. Min. of 1 freq. reading every 3°C over operation temperature

*5. S curve (fL) 3rd order curve fitting coefficient requirement over operation temperature under per 2°C test
[f (T) = C3*(T-T0)^3 + C2*(T-T0)^2 + C1*(T-T0) + C0 ; T0 = 25°C]

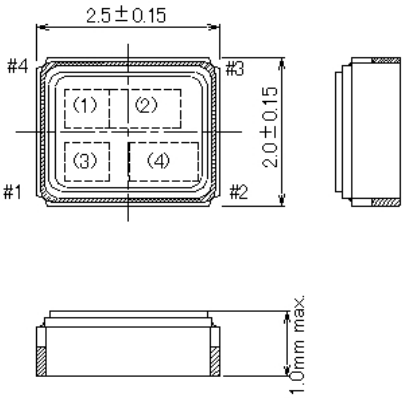
*6. Freq. slope error between measured S curve (fL) data and 3rd order curve fitting data over operation temperature under per 2°C test

*7. 10nW to 100uW to 10nW

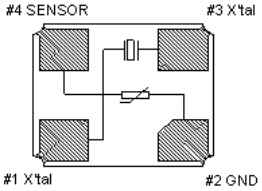
Thermistor

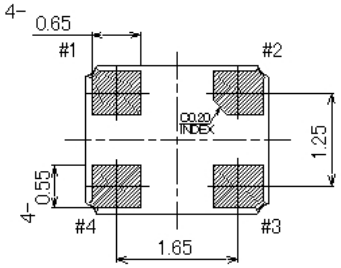
	Item	Limits			unit	Conditions
		min.	typ.	max.		
1	Resistance	-	100	-	kΩ	T_A=+25°C
2	B-constant	-	4250	-	K	+25°C - +50°C

2. DIMENSIONS AND MARKING



Connection (Top View)





Marking

Country	(1) Model code	(2) Frequency (MHz, 3digits)	(3) Logo	(4) Date code
THAILAND	TH	26.0	• D	Year (1digit) +Week (2digits) e.g.2013/1/1→ 401

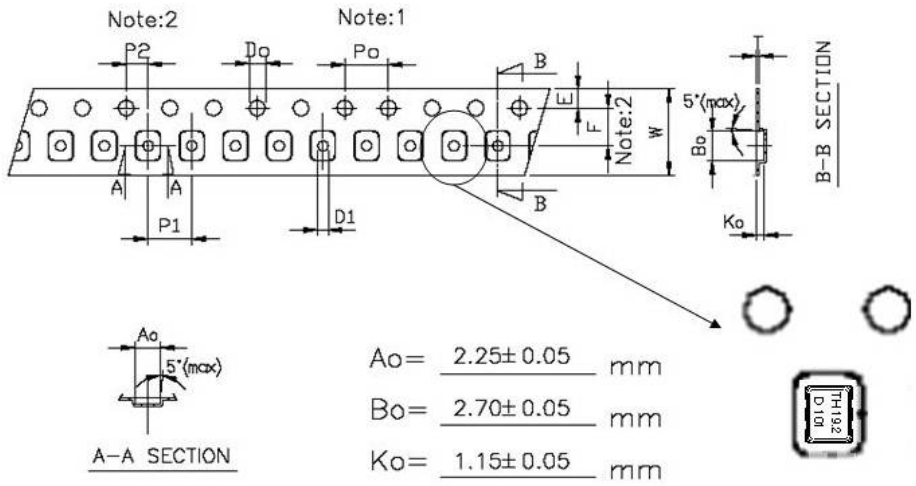
unit:mm general dimension tolerance:0.1mm

Figure-1

TITLE DSR221STH TYPE QUARTZ CRYSTAL SPECIFICATION	REMARK		
DATE	SPEC. No.	REV.	PAGE
2014/06/30	-		3 / 15

3. EMBOSS CARRIER TAPE & REEL

(1) Dimensions of embossed carrier tape



Unit: mm

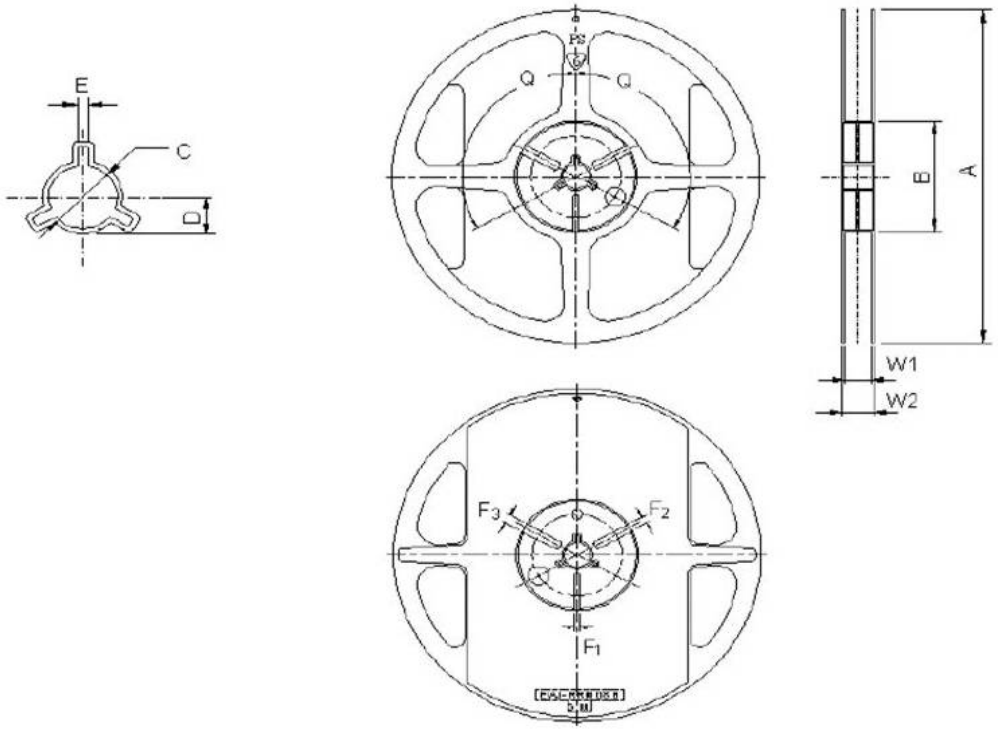
Symbol	Spec.
K1	–
Po	4.0± 0.10
P1	4.0± 0.10
P2	2.0± 0.05
Do	1.55± 0.05
D1	1.10± 0.10
E	1.75± 0.10
F	3.50± 0.05
10Po	40.0± 0.20
W	8.0± 0.20
T	0.25± 0.05

Notice:

1. 10 Sprocket hole pitch cumulative tolerance is ±0.12mm
2. Pocket position relative to sprocket hole measured as true position of pocket not pocket hole.
3. Ao & Bo measured on a place 0.3mm above the bottom of the pocket to top surface of the carrier.
4. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
5. Carrier camber shall be not than 1mm per 100mm through a length of 250mm.

Figure-2

(2) Dimensions of tape reel



ITEM			MARK	DIMENSIONS • ANGLE
FLANCE	Diameter		A	ψ178 +1/-1
	Inner Width		W1	9.0 +/-0.3
	Outer Width		W2	11.5 +/-0.2
HUB	Out Line diameter		B	ψ60 +1.0/-0.0
	Center Core slit	Width	F1	3.0 +0.5/-0
			F2	4.0 +0.5/-0
			F3	5.0 +0.5/-0
		Position	q	120deg
	Spindle diameter		C	ψ13 +/-0.5
	Key Ditch	Width	E	2.5 +0.5/-0
		Periphery	D	11 +/-0.5

Figure-3

TITLE DSR221STH TYPE QUARTZ CRYSTAL SPECIFICATION	REMARK		
DATE	SPEC. No.	REV.	PAGE
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(3) Storage condition

Temperature : +40 °C max.
Relative Humidity : 80% max.

(It is a guaranteed term because it obtains an excellent soldering: 1 year)

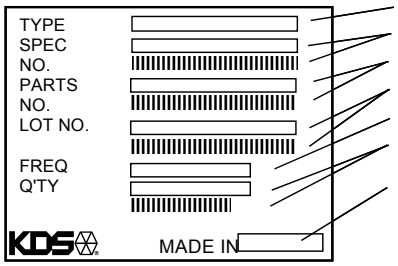
(4) Standard packing quantity

3,000 pcs/reel

(5) Material of the tape

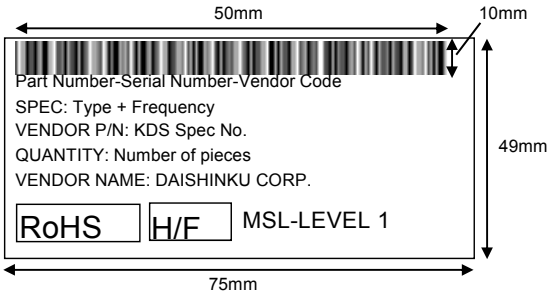
Tape	Material
Carrier tape	Polystyrene (Electrically Conductive)
Cover tape	PET+Olefin resin (Electrically Conductive)
Carrier tape	Polystyrene (Electrically Conductive)
Cover tape	PET+Olefin resin (Electrically Conductive)
Reel	Polystyrene (Electrically Conductive)

(6) Label contents



Type
Our specification No.
Your Part No.
Lot No.
Nominal Frequency
Quantity
Our Company Name
Producting Country

Stick a label on the each reel.



TITLE DSR221STH TYPE QUARTZ CRYSTAL SPECIFICATION	REMARK		
DATE	SPEC. No.	REV.	PAGE
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(7) Taping dimension

Leader	Cover-tape	The length of cover-tape in the leader is more than 400mm including empty embossed area.
	Carrier-tape	After all products were packaged, must remain more than twenty pieces or 400mm empty area, which should be sealed by cover-tape.
Terminal	Cover-tape	The tip of cover-tape shall be fixed temporary by paper tape and roll around the core of reel one round.
	Carrier-tape	The empty embossed area which are sealed by cover-tape must remain more than 40mm.

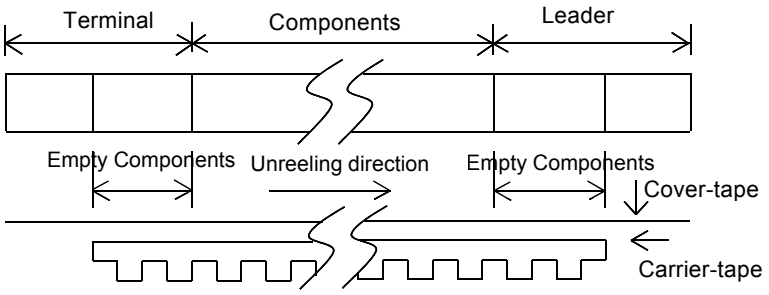


Figure-4

(8) Joint of tape
The carrier-tape and cover-tape should not be jointed.

(9) Release strength of cover tape
It has to between 0.1 ~ 0.7N under following condition.
Pulling direction 165 ~ 180 °
Speed 300mm/min
Otherwise unless specified.

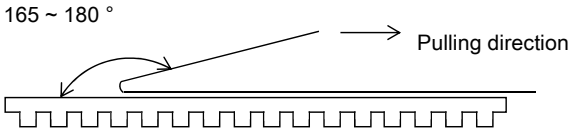
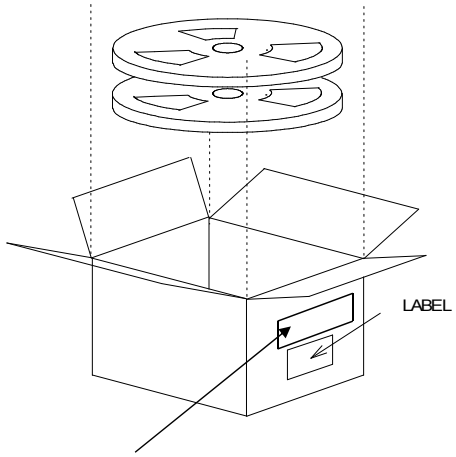


Figure-5

4. PACKING

(1) STORAGE METHOD



Label contents

The type of product
Lot No.
Specification
Quantity
Shipment Day
Remark

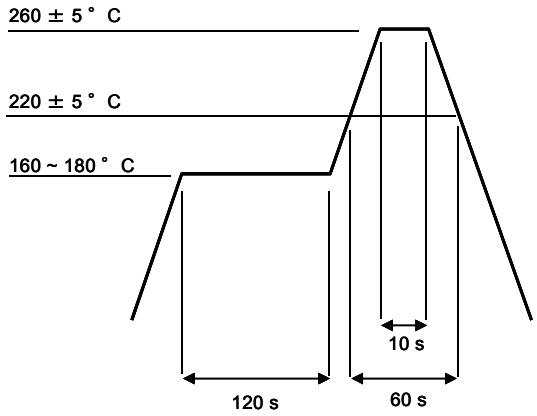
Figure-6

(2) BOX SIZE

From lot size packingsize shall be changed.
In the upper and lower part and the opening in box it shall be protected products using aircushion sheets.

5. REFLOW CONDITIONS (REFERENCE)

During the solder reflow process, please complete within following temperature, period.
Reflow soldering shall be allowed only 3 times.

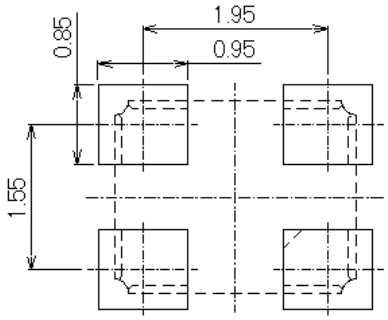


Total time : 240 s max.

Figure-7

HANDSOLDERING METHOD : +350 ± 10 °C , 3+1/-0s Each terminal once
(Please take care so that a soldering iron should not touch a product directly.)

6. LAND PATTERN (REFERENCE)



Applying under fill is not recommended.

unit : mm

Figure-8

TITLE DSR221STH TYPE QUARTZ CRYSTAL SPECIFICATION	REMARK		
DATE	SPEC. No.	REV.	PAGE
2014/06/30	-		9 / 15

7. INSIDE STRUCTURE

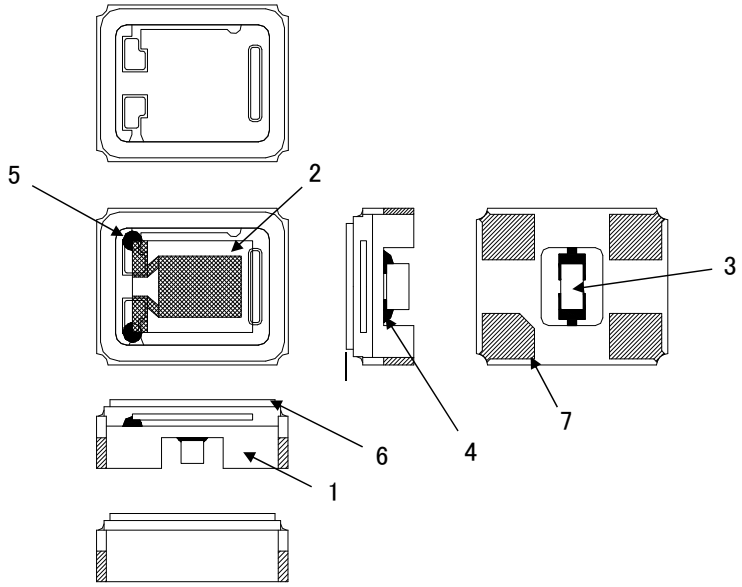
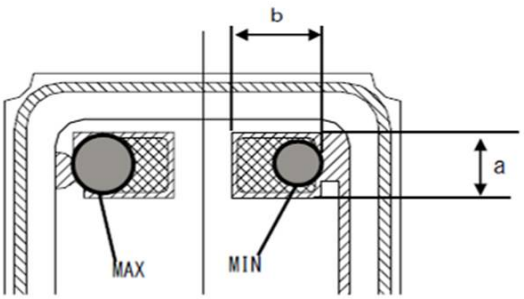


Figure-9

This is a sketch of inside construction, so the size of this drawing may not match with actual size.

7.1. COMPONENTS

			Country
1	Base(Package)	Alumina ceramics	JAPAN
2	Crystal Blank	SiO2	JAPAN
3	Thermistor	Plating material of a terminal. : Cu + Ni + Sn	JAPAN
4	Solder	Sn + Ag + Cu	JAPAN
5	Conductuig Adhesive Agent (Glue)	Silicone	JAPAN
6	Lid	Kovar + Ni: 3.0~5.0um	JAPAN
7	Plating material of a terminal.	Ni : 9um max. + Au: 0.3~1.0um(Finish)	JAPAN



Raising lower limits of adhesive against Base
Short side : Metalize “a” part : 80 - 95%
Long side : Metalize “b” part : more than 60%

8. MECHANICAL ENDURANCE

(1) SHOCK (ACCELERATION)
After the following test,parts shall conform specification 9.A
1000m/s^2 by 6ms X,Y,Z each axis (6 directions) , 3cycles

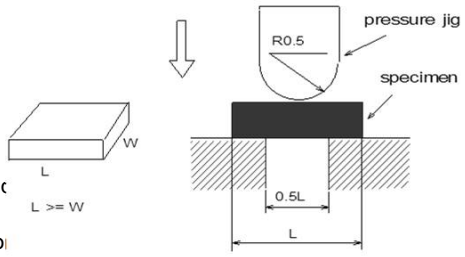
(2) SHOCK (MOUNTING DROP)
After the following test,parts shall conform specification 9.A
3cycles(18times) drop from 150 cm heights to concrete.
Further,parts shall be solderd on substrate, fixed Aluminum materials(about 100g).

Substrate materials	:	Glass Epoxy
1 cycle	:	each 1 times of 6 directions

(3) VIBRATION
After the following test,parts shall conform specification 9.A
and no abnormal appearance shall be observed.

Frequency of Vibration	:	10 ~ 500 ~ 10 Hz
Amplitude(p-p)	:	Sine waves of 1.5mm or 100m/s^2
Cycle	:	11min
Vibration axis	:	X.Y.Z
Vibration period	:	2 h for each axis

(4) SEAL
Less than 2.0×10^{-9} Pa m^3/s. by Helium leak detector.
Also, no serial bubble is observed by Fluorocarbon tests.



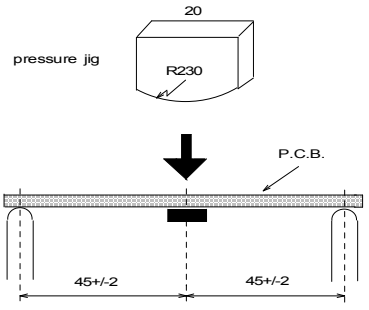
(5) SOLDERABILITY
After the following test, more than 95% of terminal shall be c
3 ± 0.5 s dip in +245 ± 5 °C solder.
(Solder composition : Sn-3Ag-0.5Cu) (Use rosin type flux fo

(6) RESISTANCE TO SOLDERING HEAT (REFLOW)
48 h past at room temperature from following test,parts shall conform specification 9.A
perform the attached Reflow conditions to reference.

(7) RESISTANCE TO SOLDERING HEAT (HAND SOLDERING METHOD)
48 h past at room temperature from following test,parts shall conform specification 9.A
+350 ± 10°C , 3+1/-0s Each terminal once.

(8) SUBSTRATE BENDING
After the following test,parts shall conform specification 9.A
and no abnormality shall be observed in external appearance and sealing
tightnen and others shall be based on ET-7403 of EIAJ.
Mount the specimen on substrate.
Apply the following pressure

Direction	:	see right figure
Speed	:	about 1.0 mm/s
Hours	:	5 ± 1 s
Amount of substrate	:	3 mm max.

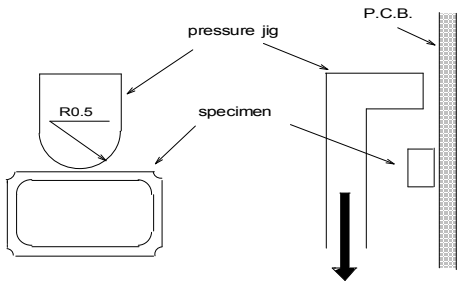


(9) SHEAR

After the following test,parts shall conform specification 9.A
and no abnormality shall be observed in external appearance and sealing
tightness and others shall be based on ET-7403 of EIAJ.

Mount the specimen on substrate.
Apply the following pressure

Weight	:	10 N
Hours	:	10 ± 1 s
Direction	:	see right figure

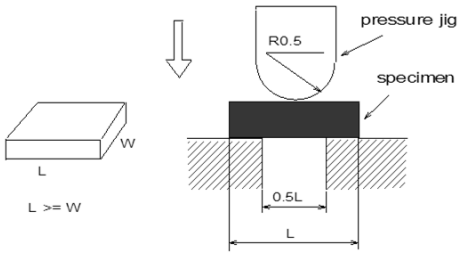


(10) BODY STRENGTH

After the following test,parts shall conform specification 9.A
and no abnormality shall be observed in external appearance and sealing
tightness and others shall be based on ET-7403 of EIAJ.

Mount the specimen on substrate.
Apply the following pressure

Weight	:	5N
Hours	:	10 ± 1 s
Direction	:	see right figure



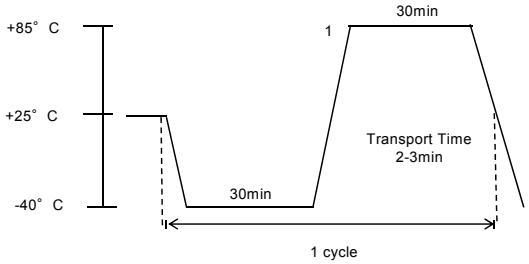
9. ENVIRONMENTAL ENDURANCE

(1) LOW TEMPERATURE
2 h past at room temperature after following test, parts shall conform specification 9.A
240 h , -40 ± 3 °C.

(2) HUMIDITY
2 h past at room temperature after following test, parts shall conform specification 9.A
240 h , +85 ± 2 °C , relative humidity 85 ± 5%.

(3) HIGH TEMPERATURE
2 h past at room temperature after following test, parts shall conform specification 9.A
240 h , +85 ± 2 °C.

(4) TEMPERATURE CYCLE
2 h past at room temperature after 1000 cycles of followingtest, parts shall conform specification 9.A



10. SPECIFICATION

Frequency Variation and Equivalent Resistance shall be within Table below after the reliability test.

Spec.	Frequency Variation	Equivalent Resistance
A	±2ppm	±15 % or 2.0 Ω max. (Use larger specification)
B	±5ppm	±20 % or 3.0 Ω max. (Use larger specification)
C	±10ppm	±20 % or 3.0 Ω max. (Use larger specification)
D	±20ppm	±25 % or 10.0 Ω max. (Use larger specification)

11. DSR221STH TYPE QUARTZ CRYSTAL HANDLING INSTRUCTIONS

(1) SOLDERING

Please perform the attached Reflow conditions to reference within 3 times.

(2) MOUNT

Crystal products are designed to be compatible with automatic mounting.
Be sure to have a mounting test in advance by using the actual mounting machine
and check that the characteristics of the products are not damaged
by the automatic mounting.
In the process where the boad is warped, such as board separation process,
be careful that the warping does not influence the characteristics
and soldering of crystal products.
Since mounting by Ultrasonic welding and processing have a possibility of an excessive
vibration spreading inside a crystal resonator and becoming the cause of characteristic
deterioration and not oscillating, it does not recommend.

(3) WASHING

About use of the washing liquid of a basin system,
an alcoholic system, and a chlorofluorocarbon-replacing
material system, it is checking that it is satisfactory.
However please consult in advance about other washing liquid.
Although the check about ultrasonic washing is performed,
since it is an examination with a simple substance,
the check for the second time by the use state is recommended.

(4) THE CAUTIONS ON USE

The piece of crystal it is processed very smaller than the conventional thing
inside DSR221STH series crystal unit may be damaged,
if excessive excitation electric power is applied.
Please use it below with the value specified on a catalog and specifications.
Please refrain from forming patterns between crystal land pattern's since there is
a possibility to cause crack in base.

(5) HANDLING OF A PRODUCT

DSR221STH series has sufficient intensity to fall and vibration.
However when too much shock is added according to a certain cause,
the use after a characteristic check is recommended.

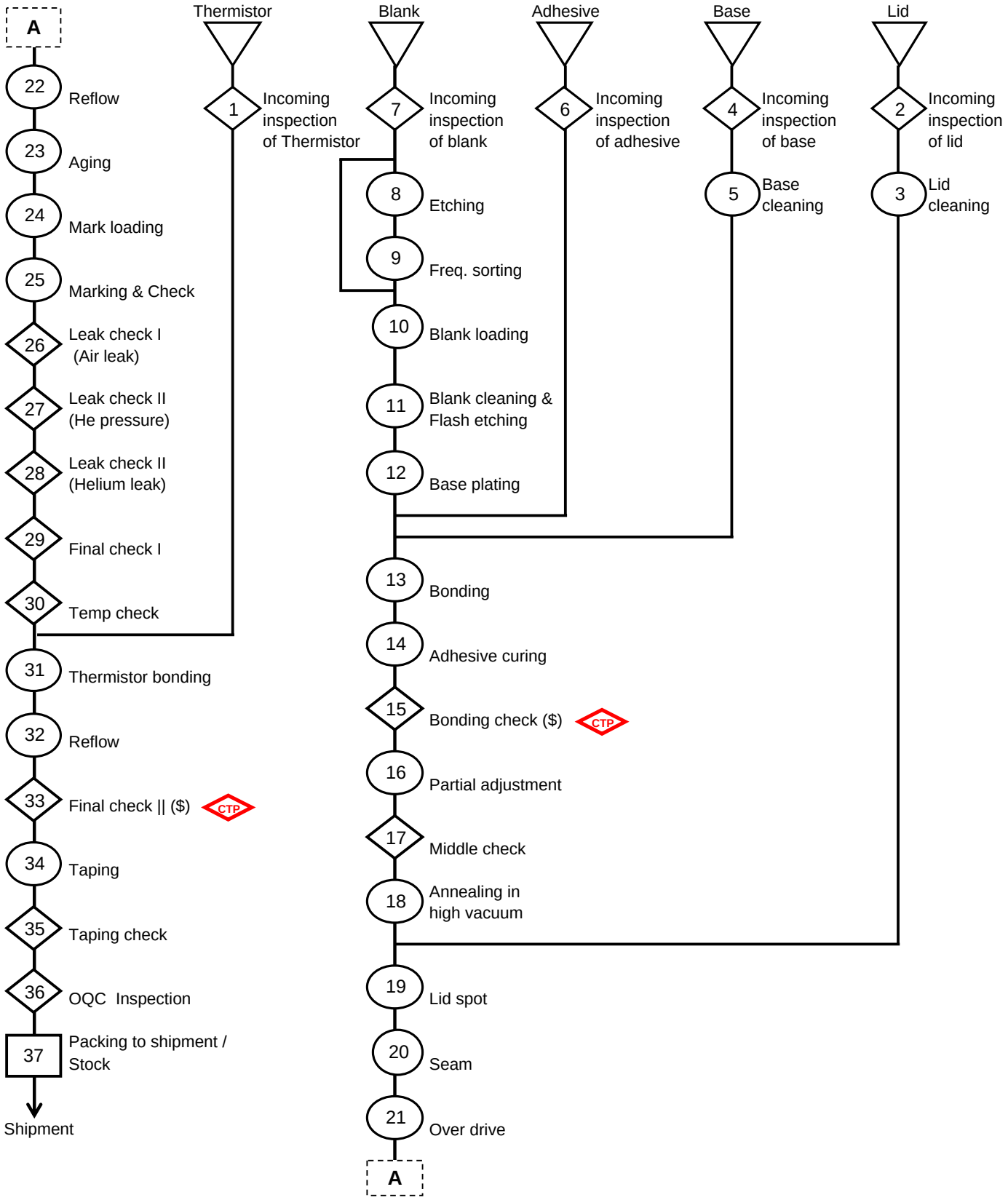
(6) STORAGE

Since the soldering nature of a terminal may be degraded,
please avoid storage in high temperature and a humid place.
Please keep it in the place which direct rays do not hit
and dew condensation does not generate.

2014-0217B REVISION RECORD

Rev.No	Date	Reason	Contents	Approved	Checked	Drawn
-	2014/2/17	-	Initial Release	A.Hishikawa	H.Takase	H.Takase
A	2014/06/10	Customer's request	Raising lower limits of adhesive … Marking LOT After 420 Changing design of Crystal Blank … Shipment after 25th April	A.Hishikawa	H.Takase	H.Takase
B	2014/06/30	Customer's request	7. INSIDE STRUCTURE Addition of raising lower limits of adhesive	A.Hishikawa	H.Takase	H.Takase

HARMONY ELECTRONICS (THAILAND) CO.,LTD.	Doc No. : PF-QA-009	Page No. : 1 OF 1
	Title : PROCESS FLOWCHART DSR221STH SERIES	Issue Date : 15-05-2013
	Revision : 001	Effective Date : 16-05-2013



REMARK: ▽ RAW MATERIAL STORE ◇ PRODUCT INSPECTED BY QC INSPECTOR (QC.)

○ PRODUCTION □ FINISHED PRODUCT STORE

HELE	DOC NO:	CP-QA-007		PAGE NO:	1-10 OF 11		
	TITLE:	QUALITY CONTROL PLAN DSR221STH SERIES		ISSUED DATE	15-05-2013		
HARMONY ELECTRONICS (THAILAND CO., LTD.	REVISION:	001		EFFECTIVED DATE	16-05-2013		
PROTOTYPE x	PRE-LAUNCH	MASS PRODUCTION	APPROVED BY:	CUSTOMER ENGINEERING APPROVAL	--		(IF REQ'D)
CONTROL NO.	REV NO:		CUSTOMER NAME:	CUSTOMER QUALITY APPROVAL	--		(IF REQ'D)
ITEM	PART NO:		CUSTOMER NAME:	OTHER APPROVAL	--		(IF REQ'D)
PLANT NAME HARMONY (THAI)	PLANT NO:		PREPARED BY:	Harmony Thai: Phisit (Factory Manager), Pairoj (Production), Anupong (Engineer), Arvin (QA) / Harmony Taiwan: Steven, Donald (QA)			

PROCESS NO:	PROCESS NAME/ OPERATION DESCRIPTION	MACHINE DEVICE JIG, TOOL FOR MFG	CHARACTERISTICS		SPECIAL CHAR.	METHODS						REACTION PLAN
			PRODUCT	PROCESS		PRODUCT/ PROCESS SPECIFICATION/ TOLERANCE INTERNAL	EVALUATION MEASUREMENT TECHNIQUE	SAMPLE SIZE / QTY	SAMPLE FREQ	CONTROL METHODS	STANDARD	
1	Incoming inspeciton of Thermistor /Inspection of appearance.		Appearance			Engineering specification	Microscope (×40)	n=5pcs/Lot	1 Lot/Invoice	(Ac:Re)=(0:1)	Inspection record	1.Return to supplier 2.Use as is (Supplier corrective action request)
			Dimension			Engineering specification	Dynascope	n=5pcs/Lot	1 Lot/invoice	(Ac:Re)=(0:1)	Inspection record	
		Working table		Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
				XRF Analysis		Environment related-substance management procedure (HE-QA-24)	Schedule inspection by KDS on XRF test analysis	n=1pcs/1Time	1 Month	Final analysis report	XRF analysis report	Inform to manager, supervisor
2	Incoming inspection of lid /Inspection of Dimension & Appearance. WI-QA-IQC-001 F-QA-IQC-006 QA-BS-AP004		Appearance			Engineering specification	Microscope (×40) /Boundary sample	n=200pcs/Lot	1 Lot/Invoice	(Ac:Re)=(0:1)	Inspection record	1.Return to supplier 2.Use as is (Supplier corrective action request)
			Dimension			Engineering specification	Micrometer	n=5pcs/Lot	1 Lot/invoice	(Ac:Re)=(0:1)	Inspection record	
		Working table		Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
		(Lid Appearance check mask)		Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
		(Brush)		Cleanliness		Working instruction	Visual	1 Time	Each operation	Alcohol wash	--	Cleaning again
		Ceramic tweezer	Add X-bar R chart in Bonding strength and DLD P chart in Final check	Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
				Storage time		Working instruction	Visual	1 Time	Each invoice	6 Months MAX	Invoice Record	Re-inspection
				HSF Requirements		Environment related-substance management procedure (HE-QA-24)	Supplier ICP data	1 Time	1 Year	ICP data Records	Inspection record	Return to supplier
				XRF Analysis		Environment related-substance management procedure (HE-QA-24)	Schedule inspection by KDS on XRF test analysis	n=1pcs/1Time	2 Months	Final analysis report	XRF analysis report	Inform to manager, supervisor
3	Lid cleaning /Cleaning the contamination of Lid, take out the moisture on the surface of lid. WI-PD-002 SOP-PD-ZLD* 5S-PD-ZLD* F-PD-ZVB-A*	Ultrasonic		US power		Working instruction	Aluminum foil wave test / Visual	1 Time	1 Day	Level 5line	Check sheet	Cleaning again
				Ultrasonic time		Working instruction	Timer	1 Time	Each operation	20 ±1 min	--	Cleaning again
				Alcohol amount		Working instruction	Visual	1 Time	Each operation	1000cc	--	Cleaning again
				Input qty.		Working instruction	Visual	1 Time	Each operation	≤120,000pcs MAX	Record/PC	Cleaning again
				Alcohol exchange		Working instruction	Visual	1 Time	Each operation	1000cc	--	Cleaning again
				Cleanliness		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
		(Stainless frame)		Deformation		Working instruction	Visual	1 Time	Each operation	Each beaker is separated clearly	--	Repair or Discard
		(Stainless box)		Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
		(Stainless basket)		Deformation		Working instruction	Visual	1 Time	Each operation	No lid drop out	--	Repair or discard
		(Stainless basket cover)		Deformation		Working instruction	Visual	1 Time	Each operation	Size match with stainless basket	--	Repair or discard
				Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
		Working table		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Dryer)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		High vacuum oven		Vacuum value		Working instruction	Vacuum monitor	1 Time	1 Day	$1X10^{-2}$Pa MAX ($1X10^{-4}$ Torr MAX)	Check sheet	Rework
				Temp.		Working instruction	Temp. monitor	1 Time	1 Day	210 ±10°C	Check sheet	Rework
						Working instruction		1 Time	3 Months	Temp. profile	Record	Rework
				Time		Working instruction	Timer	1 Time	Each operation	1Hr ±5 min	--	Rework
						Working instruction		1 Time	3 Months	Temp. profile	Record	Rework
				Input qty.		Working instruction	Visual	1 Time	Each operation	6 stainless baskets MAX (120Kpcs nearly equal)	--	Rework
				Air pressure		Working instruction	Air pressure gauge	1 Time	1 Month	0.20~0.50Mpa	Record	Rework
				N2 pressure		Working instruction	N2 pressure gauge	1 Time	1 Month	0.08~0.12Mpa	Record	Rework
				Leak		Working instruction	Visual	1 Time	Each operation	0.08~0.12Mpa	Record	Rework
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again

PROCESS NO:	PROCESS NAME/ OPERATION DESCRIPTION	MACHINE DEVICE JIG, TOOL FOR MFG	CHARACTERISTICS		SPECIAL CHAR.	METHODS						REACTION PLAN
			PRODUCT	PROCESS		PRODUCT/ PROCESS SPECIFICATION/ TOLERANCE INTERNAL	EVALUATION MEASUREMENT TECHNIQUE	SAMPLE SIZE / QTY	SAMPLE FREQ	CONTROL METHODS	STANDARD	
4	Incoming inspection of base /Inspection of Dimension & Appearance for base. WI-QA-IQC-001 QA-BS-AP003 F-QA-IQC-008 F-QA-IQC-009		Appearance			Engineering specification	Microscope (×40) / Boundary sample	n=200pcs/Lot	1 Lot/Invoice	(Ac:Re)=(0:1)	Inspection record/PC	1.Return to supplier 2.Use as is (Supplier corrective action request)
			Dimension			Engineering specification	Dynascope/ Micrometer	n=5pcs/Lot	1 Lot/Invoice	(Ac:Re)=(0:1)	Inspection record/PC	
		Working table		Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
		Ceramic tweezer		Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
				Storage time		Working instruction	Visual	1 Time	Each invoice	6 Months MAX	Invoice record	Re-inspection
			Environment	HSF Requirements		Environment related-substance management procedure (HE-QA-24)	Supplier ICP data	1 Time	1 Year	ICP data Records	Inspection record	Return to supplier
				XRF Analysis		Environment related-substance management procedure (HE-QA-24)	Schedule inspection by KDS on XRF test analysis	n=1pcs/1Time	2 Months	Final analysis report	XRF analysis report	Inform to manager, supervisor
5	Base cleaning /Transfer the base from the base package into bonding tray by manual. Cleaning the foreign object of base by N2 blow by. WI-PD-002 SOP-PD-ZIN* 5S-PD-ZIN* F-PD-ZIN*	Base cleaning N2 machine		N2 blow position control		Working instruction	Visual	1 Time	1 Shift	Normal returning of original position	--	Rework
				N2 pressure		Working instruction	Pressure gauge	1 Time	1 Shift	1.0~4.0 kg/cm^2 [0.10~0.40 Mpa]	Check sheet	Cleaning again
				N2 blow setting time		Working instruction	Display monitor	100%	Each operation	1300±1s/2 Bonding jig	--	Cleaning again
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again
		(Bonding tray frame)		Cleanliness		Working instruction	Visual	1 Time	1 Lot	Cleancloth with alcohol	--	Cleaning again
		(Bonding tray)		Deformation		Working instruction	Visual	1 Time	1 Month	--	--	Repair or discard
				Cleanliness		Working instruction	Visual	1 Time	1 Month	US alcohol	--	Cleaning again
		(Bonding magazine)		Deformation		Working instruction	Visual	1 Time	1 Month	--	--	Repair or discard
				Cleanliness		Working instruction	Visual	1 Time	1 Month	5S Picture	--	Cleaning again
		Working table		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Ceramic tweezer)		Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
		(Bonding magazine shelf		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Base storage shelf)		Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
6	Incoming inspection of adhesive /Inspect condition packing & expiration date for adhesive WI-QA-IQC-001			Condition packing		Working instruction	Supplier data	1 Time	Each Lot	Seal bottle is not broken	--	Return to supplier
		Freezer		Storage temp		Engineering specification	Temp. monitor	1 Time	1 Shift	-15~-35 °C/Freezer	Check sheet	Discard
				Storage time		Engineering specification	Expiration date label	1 Time	Before use	2 Months MAX	Label on the bottle	Discard
			Environment	HSF Requirements		Environment related-substance management procedure (HE-QA-24)	Supplier ICP data	1 Time	1 Year	ICP data Records	Inspection record	Return to supplier
				XRF Analysis		Environment related-substance management procedure (HE-QA-24)	Schedule inspection by KDS on XRF test analysis	n=10g/1Time	2 Months	Final analysis report	XRF analysis report	Inform to manager, supervisor
7	Incoming inspection of blank /Inspect Freq.&Appearance& size for blank. WI-QA-IQC-001 F-QA-IQC-004 QA-BS-AP002		Freq.			Engineering specification	Network analyzer / E-5100	n= 30 pcs	Each invoice	(Ac:Re)=(0:1)	Inspection record/PC	1.Return to supplier 2.Use as is (Supplier corrective action request)
			Appearance			Engineering specification	Microscope (×40) / Boundary sample	n=200pcs	Each invoice	(Ac:Re)=(0:1)	Inspection record/PC	
			Dimension			Engineering specification	Dynascope / Micrometer / Microscope	n=5pcs	Each invoice	(Ac:Re)=(0:1)	Inspection record/PC	
		Working table		Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
		(Brush)		Cleanliness		Working instruction	Visual	1 Time	Each operation	Alcohol wash	--	Cleaning again
		Ceramic tweezer		Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
			Environment	HSF requirements		Incoming inspection spec.	Supplier ICP data	1 Time	1 Year	ICP data records	Inspection record/PC	Return to supplier
8	Etching /Match the target range of Freq. and removal of stain by NH4F. WI-PD-001 SOP-PD-ZEG* 5S-PD-ZEG* F-PD-ZEG* F-PD-ZFE-A02		Freq.			Engineering specification	Network analyzer / Crystal blank oscillator	n=10pcs	Each Lot	Etching rate	Process traveller	Rework
		Auto etching machine		Qty. control		Working instruction	Visual	>40MHz: 3000pcs MAX/Beaker 26MHz~40MHz: 5000pcs MAX/Beaker <26MHz: 8000pcs MAX/Beaker	Each operation	Qty. label	Process traveller	Count again
				NH4F Temp.		Working instruction	Temp. monitor	1 Time	1 Shift	65 ±3 °C	Check sheet	Discard/Rework
				NH4F concentration		Working instruction	Density monitor	1 Time	1 Day	33% [1.06~1.12] or 50% [1.14~1.20]	Check sheet	Discard/Rework
				NH4F volume		Working instruction	Visual	1 Time	Each operation	Indication mark	Check sheet	Discard/Rework
				Etching speed		Working instruction	Speed monitor	1 Time	Each operation	50~60 REV/min: 30 MHz~50 MHz 60~70 REV/min: 10~30 MHz	--	Discard/Rework
				NH4F exchange		Working instruction	Visual	2 Times	1 Month	15 ±1 Day	Check sheet	NH4F exchange
				DI water temp.		Working instruction	Temp. monitor	1 Time	1 Shift	60 +5 °C	Check sheet	Rework
				DI water rinse time		Working instruction	Auto timer	1 Time	1 Shift	120sec	Check sheet	Rework
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again

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			PRODUCT	PROCESS		PRODUCT/ PROCESS SPECIFICATION/ TOLERANCE INTERNAL	EVALUATION MEASUREMENT TECHNIQUE	SAMPLE		CONTROL METHODS	STANDARD	
								SIZE / QTY	FREQ			
		(Etching basket)		Deformation		Working instruction	Visual	1 Time	Each operation	No blank drop out	--	Discard
		Ultrasonic		Ultrasonic power		Working instruction	Aluminum foil wave test / Visual	1 Time	1 Day	Level 5line	Check sheet	Power level adjust
				Ultrasonic time		Working instruction	Timer	1 Time	Each operation	10 ±1 min	--	Rework
				DI water volume at tank		Working instruction	Visual	1 Time	Each operation	Water Indication level	--	Rework
				DI water volume at beaker		Working instruction	Visual	1 Time	Each operation	Amount: 500cc	--	Rework
				DI water temp. beaker		Working instruction	Temp. meter	1 Time	Each operation	70 ±10 °C	Check sheet	Rework
				Qty. control		Working instruction	Visual	>40MHz: 3000pcs MAX/Beaker 26MHz~40MHz: 5000pcs MAX/Beaker <26MHz: 8000pcs MAX/Beaker	Each operation	Qty. label	Process traveller	Count again
				Etching basket qty. (Inside tank)		Working instruction	Visual	1 Time	Each operation	Big Etching basket: 2 MAX; Small Etching basket: 6 MAX	--	Count again
				DI water exchange at beaker		Working instruction	Beaker indication label	1 Time	Each operation	--	--	Rework
				DI water exchange at tank		Working instruction	Visual	1 Time	1 Day	--	Check sheet	Rework
				IPA exchange (Beaker 3)		Working instruction	Visual	1 Time	Each operation	--	--	Rework
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
		(Stainless frame)		Deformation		Working instruction	Visual	1 Time	Each operation	Each beaker is separated clearly	--	Repair or discard
		Microwave		Microwave power		Working instruction	Visual	1 Time	1 Month	900W	--	Rework
				Etching beaker qty. (Storage drying at microwave)		Working instruction	Visual	1 Time	Each operation	Big Etching basket: 2 MAX; Small Etching basket: 4 MAX	--	Rework
				Time		Working instruction	Auto timer	1 Time	Each operation	20 min	--	Rework
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
		Working table		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
9	Freq. sorting /Sort the Freq. of blank according to rate Engineering specification. WI-PD-001 SOP-PD-ZFS* F-PD-ZFS* QA-BS-AP002		Freq.			Engineering specification	Network analyzer / Crystal blank oscillator	1 Time	1 Lot	100%	Sampling check sheet	Rework
			Appearance			Engineering specification	Microscope (×40) / Boundary sample	1 Time	1 Lot	100%	Sampling check sheet	Discard
		Sorting machine		Sorting accuracy		Working instruction	Network analyzer / Crystal blank oscillator	1 Time	1 Lot	n=10pcs	Process traveller	Rework
				Electrode gap		Working instruction	Digital micrometer	1 Time	1 Lot	TYP. 0.04mm	Panda Type: Light Indication KDS Type: Feeler gauge	Rework
				Nozzle gap		Working instruction	Feeler gauge	1 Time	1 Lot	TYP. 0.3mm	--	Rework
				Flatness & parallelness for electrode		Working instruction	Visual / Boundary sample	1 Time	1 Shift	--	Check sheet	Electrode exchange
				Blank qty. at bowl feeder		Working instruction	Visual	1 Time	Each operation	≤1500pcs	--	Remove excessive amount
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again
		(Humidification cleancloth)		Humidification condition		Working instruction	Visual	1 Time	Each operation	--	--	Humidification
				Cleanliness		Working instruction	Visual	1 Time	1 Day	Alcohol wash	--	Cleaning again
		Steamer (Use when blank often overlap)		Steam condition		Working instruction	Visual	1 Time	Each operation	--	--	Machine maintenance
				M/C cleaning		Working instruction	Visual	1 Time	1 Week	Cleancloth with alcohol	--	Cleaning again
		Working table		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Microscope)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Microscope glass)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Weighing scale)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Brush)		Cleanliness		Working instruction	Visual	1 Time	1 LOT	Alcohol wash	--	Cleaning again
10	Blank loading	Load blank machine		Suction nozzle gap		Working instruction	Feeler gauge	1 Time	Each operation	0.3mm TYP.	No blank broken	Rework
				N2 pressure		Working instruction	Pressure gauge	1 Time	1 Month	Each machine	Checksheet	Rework
				Blank qty. at bowl feeder		Working instruction	Visual	1 Time	Each operation	≤1500pcs	--	Remove excessive amount
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
		(Load blank magazine)		Deformation		Working instruction	Visual	1 Time	1 Week	--	--	Repair or discard
				Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
		(Flash mask)		Deformation		Working instruction	Visual / Boundary sample	1 Time	Each operation	100%	--	Repair or discard
		Steamer (Use when blank often overlap)		Steam condition		Working instruction	Visual	1 Time	Each operation	--	--	Machine maintenance
				M/C cleaning		Working instruction	Visual	1 Time	1 Week	Cleancloth with alcohol	--	Cleaning again
		Working table		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Ceramic tweezer)		Cleanliness		Working instruction	Visual	1 Time	Each lot	Cleancloth with alcohol	--	Cleaning again
		(Screw driver)		Cleanliness		Working instruction	Visual	1 Time	Each lot	Cleancloth with alcohol	--	Cleaning again
		(Screw)		Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
		(Screw round box with stainless strainer)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again

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			PRODUCT	PROCESS		PRODUCT/ PROCESS SPECIFICATION/ TOLERANCE INTERNAL	EVALUATION MEASUREMENT TECHNIQUE	SAMPLE SIZE / QTY	SAMPLE FREQ	CONTROL METHODS	STANDARD	
		(Jig cover for flash mask)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Load blank mask holder jig)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Brush)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Flash mask stainless strainer)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Round stainless box)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Clean cloth container)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Mask storage box & mask storage box S size)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
11	Blank cleaning & Flash etching /Cleaning surface and take out blank dust for blank. WI-PD-002 SOP-PD-ZFE* 5S-PD-ZFE* 5S-PD-MFG* F-PD-ZFE*	Blank cleaning & flash etching machine		FILL CLEANING LIQUID (Tank 2 & 3)		WORKING INSTRUCTION	Visual	1 Time	1 SHIFT	250 cc	Check sheet	Liquid P3 exchange
		(US machine)		Water temp. (Tank 2 and 3)		Working instruction	Temp. monitor	1 Time	1 Day	50~60 °C	Check sheet	Rework
				Ultrasonic power (Tank 2 and 3)		Working instruction	Aluminum foil wave test / Visual	1 Time	Each Cycles	720 Cycles	Record	Rework
				Liquid P3 exchange (Tank 2 and 3)		Working instruction	Counter	1 Time	Each Cycles	720 Cycles	Check sheet	Rework
				DI water temp. (Tank 10)		Working instruction	Temp. monitor	1 Time	1 Day	50~60 °C	Check sheet	Rework
				NH4F water temp. (Tank 9)		Working instruction	Temp. monitor	1 Time	1 Day	40 ±5 °C	Check sheet	Rework
				NH4F concentration (Tank 9)		Working instruction	Ammonium concentration monitor	1 Time	1 Day	16~21	Check sheet	Rework
				NH4F exchange (Tank 9)		Working instruction	Counter	1 Time	Each Cycles	720 Cycles	Check sheet	Rework
				DI water Temp. (Tank 11)		Working instruction	Temp. monitor	1 Time	1 Day	50~60 °C	Check sheet	Rework
				Ultrasonic power (Tank 4,5,12)		Working instruction	Aluminum foil wave test / Visual	1 Time	Each Cycles	720 Cycles	Record	Rework
				Ultrasonic DI water volume		Working instruction	Visual	1 Time	Each operation	(Full)	--	Rework
				DI water conductivity (Tank 13)		Working instruction	Conductivity monitor	1 Time	1 Day	0.45 μs/cm MAX	Check sheet	Rework
				Cleaning time		Working instruction	Auto timer	1 Time	Each operation	300sec	--	Rework
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
		(Flash mask magazine)		Deformation		Working instruction	Visual	1 Time	Each operation	Boundary sample	--	Repair or discard
		Storage table		Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
		Hydro extractor machine		Magazine qty.		Working instruction	Visual	1 Time	Each operation	2 or 4 flash mask magazines	--	Count again
				Spindle speed		Working instruction	Speed monitor	1 Time	1 Shift	STEP 1:600 ±5 RPM STEP 2:800 ±5 RPM	Check sheet	Rework
				Spindle time		Working instruction	Timer	1 Time	Each operation	STEP 1:30sec, STEP 2:450sec	--	Rework
				N2 pressure		Working instruction	Pressure gauge	1 Time	1 Day	0.10~0.40 Mpa (1~4 kg/cm^2)	Check sheet	Rework
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
		Clean oven		Mask storage box qty.		Working instruction	Visual	1 Time	Each operation	1 floor: 4 boxes MAX.	--	Count again
				Temp.		Working instruction	Temp. monitor	1 Time	1 Shift	120 ±5 °C	Check sheet	Rework
								1 Time	3 Months	Temp. profile	Record	Rework
				Time		Working instruction	timer	1 Time	Each operation	30~40 min	Process traveller	Rework
								1 Time	3 Months	Temp. profile	Record	Rework
				N2 pressure		Working instruction	Pressure gauge	1 Time	1 Shift	1~3 kgf/cm^2	Check sheet	Rework
				Hepa pressure		Working instruction	Hepa gauge	1 Time	1 Shift	5~15 PSIG	Check sheet	Rework
				N2 flow		Working instruction	N2 meter	1 Time	1 Shift	40~60 l/min	Check sheet	Rework
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
12	Base plating /Ag, Au, Cr plating on the crystal blank to reach the target frequency range. WI-PD-002 SOP-PD-ZBP* 5S-PD-ZBP* F-PD-ZBP* QA-BS-BP* F-PD-MFG-001 F-MAINT-ZBP-001* F-MAINT-ZBP-002* F-MAINT-ZBP-003*			Ag / Au		Engineering specification	Visual	1 Time	Each invoice	Supplier's inspection report	Record	1.Return to supplier 2.Use as is (Supplier corrective action request)
				Cr		Engineering specification	Visual	1 Time	Each invoice	Supplier's inspection report	Record	
				Freq.		Engineering specification	S&A 250B/Freq. measure	1 Time	Each Lot	5pcs	Record	Test again
				Electrode strength		Engineering specification	3M tape / Boundary sample	1 Time	1 Shift	5pcs (No detached plating)	Record	Test again
				Appearance		Engineering specification	Microscope (×40) / Boundary sample	1 Time	Each Lot	100%	Process traveller	Discard
		Sputtering machine SPH-2510 SPH-2712		Target (Ag/Au/Cr) condition		Working instruction	Visual	1 Time	Each operation	Each machine	Record/PC	Discard
				Blank storage time		Working instruction	Visual	1 Time	Each operation	12H MAX / After cleaning	Process traveller	Cleaning again
				Vacuum value		Working instruction	Vacuum monitor	1 Time	1 Months	2.0×10^{-1}~6.0×10^{-1}Pa	Checksheet	Discard

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			PRODUCT	PROCESS		PRODUCT/ PROCESS SPECIFICATION/ TOLERANCE INTERNAL	EVALUATION MEASUREMENT TECHNIQUE	SAMPLE		CONTROL METHODS	STANDARD	
								SIZE / QTY	FREQ			
				Vacuum time		Working instruction	Timer	1 Time	1 Months	Each machine	Checksheet	Discard
				Argon gas pressure		Working instruction	Indicator monitor	1 Time	Each operation	4.0 SCCM: SPH 2510 TYPE	Checksheet	Discard
				Cryo temp.		Working instruction	Monitor	1 Time	Each operation	10~30 kelvin	Checksheet	Discard
				Slow leaks		Working instruction	Timer	1 Time	1 Month	>30s	Checksheet	Machine maintenance
		(Hepa)		Particle value		Working instruction	Visual	1 Time	4 Month	--	Record	Machine maintenance
		(Exhaust)		Suction power		--	Visual	1 Time	1 Year	Cleanroom master exhaust status OK	-	Machine maintenance
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again
		(Dummy mask)		Cleanliness		Working instruction	Visual	1 Time	Change of target	Nitric and powder cleaning	--	Cleaning again
				Mask/Spacer size		Engineering specification	Visual	1 Time	1 Lot	Each specification	Process traveller	Discard
		(BP mask)		Mask cleaning		Working instruction	Visual	1 Time	10 Cycles MAX.	Acid cleaning	Record	Cleaning again
				Differential pressure		Working instruction	Pressure gauge	1 Time	1 Shift	60~140 Pa	Check sheet	Adjust pressure
		Clean bench		ESD control		Working instruction	Static measure	1 Time	1 Month	±50V	Record	Cleaning again
				M/C cleaning		Working instruction	Visual / Particle counter	1 Time	1 Shift/1 Month	5S Picture	Check sheet/Record	Cleaning again
		(Vacuum jig)		Vacuum strength		Working instruction	Pressure gauge	1 Time	1 Month	3~7 kg/cm^2 (0.3 ~0.7 Mpa)		Adjust pressure
				Cleanliness		Working instruction	Visual	1 Time	Each lot	Cleancloth with alcohol	--	Cleaning again
		(Ionizer)		ESD control		Working instruction	Static measure	1 Time	1 Month	±50V	Record	Machine maintenance
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Microscope)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Microscope glass)		Cleanliness		Working instruction	Visual	1 Time	Each lot	Cleancloth with alcohol	--	Cleaning again
		(Screw driver)		Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
		(Screw rectangular box)		Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
		(Jig cover for BP mask)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(BP mask jig holder)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Mask jig holder)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Blank guide mask)		Cleanliness		Working instruction	Visual	1 Time	Each lot	Cleancloth with alcohol	--	Cleaning again
		(Stainless strainer)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Box transfer BP with stainless strainer)		Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
		(Ceramic tweezer)		Cleanliness		Working instruction	Visual	1 Time	Each lot	Cleancloth with alcohol	--	Cleaning again
		(Glass dish)		Cleanliness		Working instruction	Visual	1 Time	Each lot	Cleancloth with alcohol	--	Cleaning again
		(Counter)		Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
		(Blank tray)		Cleanliness		Working instruction	Visual	1 Time	1 Month	US alcohol	--	Cleaning again
		Finger cots		Exchange		Working instruction	Visual	1 Time	2 Hours	--	--	Exchange
		N2 blow machine		N2 pressure		Working instruction	Pressure gauge	1 Time	1 Shift	0.20 ~0.40 Mpa	Check sheet	Rework
				Blow time		Working instruction	Timer	100%	Each operation	TYP. 8sec/1side	--	Rework
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again
		Dry box (Desiccator)		Humidity		Working instruction	Humidity meter	1 Time	1 Day	20% MAX	Check sheet	Adjust N2 flow
				Temp.		Working instruction	Temp. monitor	1 Time	1 Shift	50 ±10 °C	Check sheet	Adjust Temp.
				N2 flow		Working instruction	Flow meter	1 Time	1 Shift	4~6 l/min	Check sheet	Adjust N2 flow
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
13	Bonding /Bonding blank on base by correct value of Adhesive. WI-PD-002 SOP-PD-ZIN* 5S-PD-ZIN* F-PD-ZIN* F-PD-MFG-001		Base type			Engineering specification	Visual	1 Time	Each lot	Each specification	Process traveller	Change specification or discard
		Adhesive		Storage temp.		Engineering specification	Temp. monitor	1 Time	1 Shift	-15~-35 °C/Freezer	Check sheet	Discard
				Storage time		Engineering specification	Expiration date label	1 Time	Each bottle	2 Months MAX	Record	Discard
				Adhesive rest time after take out from freezer		Working instruction	Timer	1 Time	Each operation	60~90 min	Record	Discard
				Mix method / time		Working instruction	Timer	1 Time	Each operation	5 min (approximate)	Record	Mix again
				Defoaming time		Working instruction	Timer / Adhesive mixer	1 Time	Each operation	30sec	Record	Defoaming again
				Adhesive use time		Engineering specification	Visual	1 Time	6 ±1 Hours	321: 0.16~0.18 ml. (0.25mmΦ) 221: 0.16~0.18 ml. (0.20mmΦ)	Check sheet	Exchange adhesive
		Working table		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	-	Cleaning again
		Bonding machine		Adhesive apply amount		Engineering specification	CCD camera / Boundary sample	1 Time	Each Lot	100%	Process traveller	Discard
				Blank nozzle gap		Working instruction	Visual	1 Time	1 Shift	No blank broken	Check sheet	Adjust again
				Base nozzle gap		Working instruction	Visual	1 Time	1 Shift	No base crack	Check sheet	Adjust again
				Air pressure		Working instruction	Pressure gauge monitor	1 Time	1 Shift	0.20~0.60Mpa	Check sheet	Adjust again
				N2 pressure		Working instruction	Pressure gauge monitor	1 Time	1 Shift	0.20~0.40Mpa	Check sheet	Adjust again
				Base clip pressure		Working instruction	Pressure gauge monitor	1 Time	1 Shift	0.05~0.20Mpa	Check sheet	Adjust again
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again
				Syringe & needle exchange		Working instruction	Visual	1 Time	6 ±1 Hours	321: 0.16~0.18 ml. (0.25mmΦ) 221: 0.16~0.18 ml. (0.20mmΦ)	Check sheet	Exchange adhesive
		(Mask box)		Cleanliness		Working instruction	Visual	1 Time	1 Month	Cleancloth with alcohol	--	Cleaning again
		(Bonding magazine)		Deformation		Working instruction	Visual	1 Time	1 Month	--	--	Repair or discard
				Cleanliness		Working instruction	Visual	1 Time	1 Month	5S Picture	Check sheet	Cleaning again

PROCESS NO:	PROCESS NAME/ OPERATION DESCRIPTION	MACHINE DEVICE JIG, TOOL FOR MFG	CHARACTERISTICS		SPECIAL CHAR.	METHODS						REACTION PLAN
			PRODUCT	PROCESS		PRODUCT/ PROCESS SPECIFICATION/ TOLERANCE INTERNAL	EVALUATION MEASUREMENT TECHNIQUE	SAMPLE SIZE / QTY	SAMPLE FREQ	CONTROL METHODS	STANDARD	
		Dry box (Desiccator)		Humidity		Working instruction	Humidity meter	1 Time	1 Day	20% MAX	Check sheet	Adjust N2 flow
				Temp.		Working instruction	Temp. monitor	1 Time	1 Shift	50 ±10 °C	Check sheet	Adjust Temp.
				N2 flow		Working instruction	Flow meter	1 Time	1 Shift	4~6 l/min	Check sheet	Adjust N2 flow
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
14	Adhesive curing /Curing the adhesive according to spec of Temp. WI-PD-002 SOP-PD-ZGS* 5S-PD-ZGS* F-PD-ZGS* SD-PD-ZGS*	Clean cure oven		Curing temp.		Engineering specification	Temp. monitor	1 Time	Each operation	Room Temp ~260 °C (25±5min) + 270±10 °C (55±15min)	Process traveller	Discard
								1 Time	3 Months	Temp. profile	Record	Discard
				Input qty.		Working instruction	Visual	1 Time	Each operation	1 Bonding tray	Process traveller	Count again
				Storage time unit curing		Engineering specification	Timer	1 Time	Each operation	1 Hour MAX	Process traveller	Discard
				Belt speed		Working instruction	Speed monitor	1 Time	1 Day	Each machine	Check sheet	Discard
				Oxygen concentration		Engineering specification	Oxygen analyzer	1 Time	1 Day	30ppm MAX	Check sheet	Discard
				N2 flow		Working instruction	N2 monitor	1 Time	Each operation	N2 flow Indication	Check sheet	Discard
				DI water exchange and belt cleaning		Working instruction	Visual	1 Time	1 Month	--	Check sheet	Cleaning again
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
15	Bonding check /Inspection of bonding conditions. WI-PD-002 SOP-PD-ZIP* 5S-PD-ZIP* F-PD-ZIP* QA-BS-IN* RD-TQ-013*		Bonding strength		$ CTP	Engineering specification	Pulling tester with fixing part jig	5pcs	1 Shift	>20g	Record (X bar R chart)	Discard
			Bonding condition			Engineering specification	Microscope (×40) / Boundary sample	1 Time	Each Lot	100%	Process traveller	Discard
		Clean bench		Differential pressure		Working instruction	Pressure gauge	1 Time	1 Shift	60~140 Pa	Check sheet	Adjust pressure
				ESD control		Working instruction	Static measure	1 Time	1 Months	±50V	Record	Machine maintenance
				M/C cleaning		Working instruction	Visual / Particle counter	1 Time	1 Shift/1 Month	5S Picture	Check sheet	Cleaning again
		(Microscope) (Counter)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
				Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
16	Partial adjustment /adjust the Freq. and meet spec by milling (ion partial). WI-PD-003 SOP-PD-ZAJ* 5S-PD-ZAJ* F-PD-ZAJ* F-MAINT-ZPM-004* F-MAINT-ZPM-005*		Freq.			Engineering specification	Network analyzer	1 Time	Each lot	Each specification	Process traveller	Adjust again
		Ion partial machine (Freq. adjust)		Chamber vacuum		Working instruction	Vacuum gauge monitor	1 Time	1 Month	7×10^{-4}Torr MAX	Check sheet	Machine maintenance
				Argon gas pressure		Working instruction	Argon gauge monitor	1 Time	1 Month	0.13 Mpa MIN	Check sheet	Machine maintenance
				Ion gun exchange		Working instruction	Visual	1 Time	1 Week	PM control	Record	Ion gun exchange
				Shutter exchange		Working instruction	Visual	1 Time	1 Week	PM control	Record	Shutter exchange
				Cryo temp.		Working instruction	Monitor	1 Time	1 Month	10~30 Kelvin	Checksheet	Discard
				Pin condition		Working instruction	Visual / Monitor	1 Time	Each operation	Operation condition	--	Machine maintenance
				Pin exchange		Working instruction	Visual	1 Time	1 Month	PM control	Record	Pin exchange
				Air pressure		Working instruction	Air gauge monitor	1 Time	1 Month	0.30~0.60 Mpa	Checksheet	Adjust pressure
				N2 pressure		Working instruction	N2 gauge monitor	1 Time	1 Month	0.20~0.40 Mpa	Check sheet	Adjust pressure
				Slow leaks		Working instruction	Timer	1 Time	1 Month	>30s	-	Adjust pressure
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
		(Over drive)		Over drive sweep power		Working instruction	Visual / Monitor	1 Time	Each operation	19 dBm	--	Rework
				Pin condition		Working instruction	Visual	1 Time	Each operation	Operation condition	--	Rework
				Pin exchange		Working instruction	Auto counter	1 Time	1 Month	PM control	Record	Pin exchange
		(Ion partial mask) (Ion partial cover & boat) (Ion partial magazine)		Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
				Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
				Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
		Clean bench		Differential pressure		Working instruction	Pressure gauge	1 Time	1 Shift	60~140 Pa	Check sheet	Adjust pressure
				ESD control		Working instruction	Static measure	1 Time	1 Months	±50V	Record	Machine maintenance
				M/C cleaning		Working instruction	Visual / Particle counter	1 Time	1 Shift/1 Month	5S Picture	Check sheet	Cleaning again
		Dry box (Desiccator)		Humidity		Working instruction	Humidity meter	1 Time	1 Day	20% MAX	Check sheet	Adjust N2 flow
				Temp.		Working instruction	Temp. monitor	1 Time	1 Shift	50 ±10 °C	Check sheet	Adjust Temp.
				N2 flow		Working instruction	Flow meter	1 Time	1 Shift	4~6 l/min	Check sheet	Adjust N2 flow
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
17	Middle check /Check Freq. and other electrical char. WI-PD-003 SOP-PD-ZMP* 5S-PD-ZMC* F-PD-ZMC*		Freq.			Engineering specification	S&A 250B	100%	Each lot	Each specification	Process traveller	Discard/Rework
			CI			Engineering specification	S&A 250B	100%	Each lot	Each specification	Process traveller	Discard
			DLD			Engineering specification	S&A 250B	100%	Each lot	Each specification	Process traveller	Discard
		Middle check machine (Freq. check)		Standard check		Engineering specification	S&A 250B	1 Time	Each lot	Each specification	Process traveller	Calibrate again
				Pin socket exchange		Working instruction	Counter	1 Time	1 Cycle	1,020,000 pcs	Check sheet	Rework
				Pin contact exchange		Working instruction	Counter	1 Time	1 Cycle	170,000 pcs	Check sheet	Rework
				Rubber nozzle exchange		Working instruction	Visual	1 Time	Each operation	Suction condition	--	Rubber nozzle exchange
				Air pressure		Working instruction	Air monitor	1 Time	1 Month	0.30~0.60 Mpa	Check sheet	Adjust pressure
				N2 pressure		Working instruction	N2 meter	1 Time	1 Month	0.20~0.40 Mpa	Check sheet	Adjust pressure
		(Over drive)		Over drive sweep power		Working instruction	Power meter with lamp	1 Time	1 Shift	TYP. 400mW (0.4~0.6 level)	Check sheet	Rework
				Pin condition		Working instruction	Visual	1 Time	Each operation	Led lamp	--	Rework
				Pin exchange		Working instruction	Auto counter	1 Time	Each operation	170000 pcs MAX	Check sheet	Pin exchange
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again
		(Anneal tray)		Deformation		Working instruction	Visual	1 Time	1 Month	Granite platform	--	Repair or discard
				Cleanliness		Working instruction	Visual	1 Time	1 Month	US alcohol	Record	Cleaning again

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			PRODUCT	PROCESS		PRODUCT/ PROCESS SPECIFICATION/ TOLERANCE INTERNAL	EVALUATION MEASUREMENT TECHNIQUE	SAMPLE SIZE / QTY	SAMPLE FREQ	CONTROL METHODS	STANDARD	
18	Annealing in high vacuum /Make electrical char. more stable and take out humidity. WI-PD-003 SOP-PD-ZVB* 5S-PD-ZVB* F-PD-ZVB*	High vacuum oven		Vacuum value		Working instruction	Vacuum monitor	1 Time	1 Day	1×10^{-2}Pa MAX	Check sheet	Rework
				Temp.		Working instruction	Temp. monitor	1 Time	Each operation	210 ±10 °C	Checksheet	Rework
						Working instruction		1 Time	3 Months	Temp. PROFILE	Check sheet	Rework
				Time		Working instruction	Timer	1 Time	Each operation	1Hr ±5 min	Process traveller	Rework
						Working instruction		1 Time	3 Months	Temp. profile	Check sheet	Rework
				Input qty.		Working instruction	Visual	1 Time	Each operation	6 jig holder MAX (28,000pcs MAX nearly equal)	Process traveller	Rework
				Air pressure		Working instruction	Air pressure gauge	1 Time	1 Month	0.20~0.50 Mpa	Checksheet	Adjust pressure
				N2 pressure		Working instruction	N2 pressure gauge	1 Time	1 Month	0.08~0.12 Mpa	Checksheet	Adjust pressure
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
		(Seam jig holder)		Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
19	Lid spot / Put the lid on the base by spot welding. WI-PD-003 SOP-PD-ZLD* 5S-PD-ZLD* F-PD-ZLD* QA-BS-WD* QA-BS-WD*	Spot seam machine		Storage time after annealing		Working instruction	Timer	1 Time	Each Lot	5 Hours MAX	Process traveller	Annealing again
				Base nozzle gap		Working instruction	Peeler gauge	1 Time	1 Day	TYP. 1.0 mm	Check sheet	Discard
				Lid nozzle gap		Working instruction	Peeler gauge	1 Time	1 Day	TYP. 0.3 mm	Check sheet	Discard
				Lid position		Working instruction	CCD monitor / Boundary sample	1 Time	Each operation	100%	Process traveller	Discard
				Electrode condition		Working instruction	Visual	1 Time	Each operation	Flatness	--	Discard
				Electrode exchange with grease		Working instruction	Auto counter	1 Time	Cycle	150±1 Kpcs	Checksheet	Discard
				Air pressure		Working instruction	Air pressure gauge	1 Time	1 Month	0.30~0.60 Mpa	Checksheet	Adjust pressure
				N2 pressure		Working instruction	N2 pressure gauge	1 Time	1 Month	0.20~0.40 Mpa	Checksheet	Adjust pressure
				ESD control		Working instruction	Static measure	1 Time	1 Months	±50V	Record	Rework
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again
	(Lid transfer operation)	Clean bench		Differential pressure		Working instruction	Pressure gauge	1 Time	1 Shift	60~140 Pa	Check sheet	Adjust pressure
				ESD control		Working instruction	Static measure	1 Time	1 Months	±50V	Record	Machine maintenance
				M/C cleaning		Working instruction	Visual / Particle counter	1 Time	1 Shift/1 Month	5S Picture	Check sheet	Cleaning again
		(Ionizer)		ESD control		Working instruction	Static measure	1 Time	1 Month	±50V	Record	Machine maintenance
		(Lid tray)		M/C cleaning		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Lid loading plate)		Cleanliness		Working instruction	Visual	1 Time	1 Month	US alcohol	--	Cleaning again
		(Cleanpaper)		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
		(Ceramic tweezer)		Exchange		Working instruction	Visual	1 Time	1 Week	--	--	Exchange
		Electo magnetic de-magnetizer machine		Cleanliness		Working instruction	Visual	1 Time	Each lot	Cleancloth with alcohol	--	Cleaning again
				De-magnet condition		Working instruction	Visual	1 Time	Each operation	No stick lid	--	De-magnet again
				Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
		Dry box (Desiccator)		Humidity		Working instruction	Humidity meter	1 Time	1 Day	20% MAX	Check sheet	Adjust N2 flow
				Temp.		Working instruction	Temp. monitor	1 Time	1 Shift	50 ±10 °C	Check sheet	Adjust Temp.
				N2 flow		Working instruction	Flow meter	1 Time	1 Shift	4~6 l/min	Check sheet	Adjust N2 flow
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
20	Seam /Seam lid and base by welding. WI-PD-003 SOP-PD-ZWD* 5S-PD-ZLD* F-PD-ZLD* QA-BS-WD001* QA-BS-WD002*		Appearance			Working instruction	Microscope (×40) / Boundary sample	100%	Each Lot	--	Process traveller	Discard
		Seam welding machine		Oven temp.		Working instruction	Temp. monitor	1 Time	1 Day	135 ±15 °C	Check sheet	Rework
		(Oven)		Oven time		Working instruction	Timer	1 Time	Each operation	60 ± 5 min	-	Rework
				Oxygen concentration		Engineering specification	Oxygen analyzer	1 Time	1 Shift	30ppm MAX	Check sheet	Discard
				Dew point		Engineering specification	Dew point meter	1 Time	1 Shift	≤ -50 °C	Check sheet	Discard
				Vacuum value		Engineering specification	Pressure gauge	1 Time	1 Day	2×10^{-4} Torr MAX	Check sheet	Discard
				Seam voltage power		Working instruction	Graph monitor indication	1 Time	1 Day	Each machine	Check sheet	Discard
				Seam time (X&Y)		Working instruction	Graph monitor indication	1 Time	1 Day	Each machine	Check sheet	Discard
				Electrode (X&Y AXIS) exchange		Working instruction	Auto counter	1 Time	1 Cycle	10±1 Kpcs	Record	Electrode exchange
				Electrode greasing		Working instruction	Visual	1 Time	1 Cycle	50±1 Kpcs	Record	Grease again
				Air pressure		Working instruction	Air pressure gauge	1 Time	1 Month	0.30~0.60Mpa	Check sheet	Adjust pressure
				N2 pressure		Working instruction	N2 pressure gauge	1 Time	1 Month	0.20~0.40Mpa	Check sheet	Adjust pressure
				M/C cleaning		Working instruction	Visual	1 Time	1 Day	5S Picture	Check sheet	Cleaning again
		(Seam tray)		Deformation		Working instruction	Visual	1 Time	1 Month	Granite platform	--	Repair or discard
				Cleanliness		Working instruction	Visual	1 Time	1 Month	US alcohol	--	Cleaning again
		(Seam magazine)		Cleanliness		Working instruction	Visual	1 Time	1 Month	Cleancloth with alcohol	--	Cleaning again

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			PRODUCT	PROCESS		PRODUCT/ PROCESS SPECIFICATION/ TOLERANCE INTERNAL	EVALUATION MEASUREMENT TECHNIQUE	SAMPLE SIZE / QTY	SAMPLE FREQ	CONTROL METHODS	STANDARD	
21	Over drive /Removing dust attached on the surface of blank by high drive level. WI-PD-003 SOP-PD-ZOD* 5S-PD-ZOD* F-PD-ZOD* QA-BS-AP*	Over drive machine (Over drive tray) (Stainless box)		Over drive sweep power		Working instruction	Power meter with lamp	1 Time	Each Lot	TYP. 400mW (0.4~0.6 level)	Process traveller	Rework
				Pin contact check		Working instruction	Visual	1 Time	1 Shift	Contact pin on the base pin	Check sheet	Pin exchange
				Pin exchange		Working instruction	Counter	1 Time	1 Month	150,000pcs	Check sheet	Pin exchange
				Socket exchange		Working instruction	Counter	1 Time	1 Month	300,000pcs	Check sheet	Socket exchange
				M/C cleaning		Working instruction	Visual	1 Time	1Shift	5S Picture	Check sheet	Cleaning again
				Deformation		Working instruction	Visual	1 Time	1 Month	Granite platform	--	Repair or discard
				Cleanliness		Working instruction	Visual	1 Time	1 Month	US alcohol	Record	Cleaning again
				Cleanliness		Working instruction	Visual	1 Time	1 Week	Cleancloth with alcohol	--	Cleaning again
22	Reflow / To detect the dust adhered on the blank surface. WI-PD-004 SOP-PD-ZRF* 5S-PD-ZRF* F-PD-ZRF*	Reflow machine (Reflow tray) (Reflow funnel)		Temp.		Engineering specification	Temp. Meter	1 Time	1 Day	265±5 °C (10sec Max.), >220 °C (125±35sec)	Check sheet	Rework
								1 Time	3 Months	Temp. profile	Record	Rework
				Belt speed		Engineering specification	Speed monitor	1 Time	1 Day	EACH MACHINE	Check sheet	Rework
				Qty.		Working instruction	Visual	1 Time	Each operation	1Lot/1tray	Process traveller	Count again
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again
				Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--	Cleaning again
				Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
23	Aging /To make the crystal electrical characteristics stable. WI-PD-004 SOP-PD-ZAG* 5S-PD-ZAG* F-PD-ZAG*	Aging oven (Aging bowl)		Temp.		Engineering specification	Temp. monitor	1 Time	1 Shift	150 ±5 °C	Check sheet	Rework
								1 Time	3 Months	Temp. profile	Record	Rework
				Time		Engineering specification	Clock	1 Time	Each lot	24 ±1 Hours	Process traveller	Rework
				Qty.		Working instruction	Visual	1 Time	Each operation	1 Lot / 1 Bowl	Process traveller	Count again
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again
				Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--	Cleaning again
24	Mark loading /To load the part in the tray before marking. WI-PD-004 SOP-PD-ZIK* 5S-PD-ZIK* F-PD-ZIK*	Loading machine (Marking magazine) (Marking tray)		Freq. confirmation		Engineering specification	S&A 250B	5pcs	Each lot	Each specification	Process traveller	Stop operation and investigation
				Base pad position		Working instruction	CCD monitor	100%	Each lot	Each specification	Process traveller	Adjust CCD
				Air pressure		Working instruction	Pressure gauge	1 Time	1 Shift	0.3 ± 0.1 Mpa	Check sheet	Adjust pressure
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again
				Cleanliness		Working instruction	Visual	1 Time	1 Month	Cleancloth with alcohol	--	Cleaning again
				Deformation		Working instruction	Visual	1 Time	Each operation	Deformation	--	Repair or discard
				Cleanliness		Working instruction	Visual	1 Time	1 Month	Cleancloth with alcohol	--	Cleaning again
25	Marking & check /Based on specification by laser marking. WI-PD-004 SOP-PD-ZIK* 5S-PD-ZIK* F-PD-ZIK* RD-TE-047*		Appearance			Engineering specification	Magnifying glass (×3) / Boundary sample	100%	Each lot	Customer specification	Process traveller	Discard
				Marking condition		Customer specification	Magnifying glass (×3)	5pcs	Each lot	Each specification	Process traveller	Discard
				Laser power		Working instruction	Monitor control	1 Time	1Shift	Each machine	Check sheet	Discard
				Plate table distance (Height adjust)		Working instruction	Micrometer	1 Time	1Shift	Each machine	Check sheet	Discard
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again
26	Leak check I (Air leak) /Inspection of grossleak WI-PD-004 SOP-PD-ZCT* 5S-PD-ZCT* F-PD-ZCT* F-MAINT-ZPM-003*		Leak check			Working instruction	Air leak machine	100%	Each lot	-	Process traveller	Discard
		Air leak machine		Machine calibration		Working instruction	Chamber calibration	1 Time	1 Shift	Crystal standard	Check sheet	Calibrate again
				Air pressure		Working instruction	Air pressure gauge	1 Time	1 Day	0.50±0.10Mpa	Check sheet	Rework
				Nozzle gap		Working instruction	Micrometer (H1/H2/H3)	1 Time	1 Shift	Each machine	Check sheet	Rework
				Nozzle exchange		Working instruction	Visual	1 Time	1Month	Each machine	Check sheet	Rework
				Product insert condition (2pcs)		Working instruction	Visual / Sensor (Alarm)	1 Time	1 Shift	Each machine	Check sheet	Discard
				O-ring exchange		Working instruction	Counter	1 Time	Cycle	500,000pcs	Record	Rework
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again
27	Leak check II (He pressure) /Pressurization of He gas. WI-PD-004 SOP-PD-ZSH* 5S-PD-ZSH* F-PD-ZSH*	Helium pressure machine		Input qty.		Working instruction	Visual	1 Time	Each operation	1 Lot / 1 Chamber	Process traveller	Rework
				He pressure		Engineering specification	Pressure gauge meter	1 Time	1Shift	5.0 ± 0.5 Kg/cm2 (0.50 ±0.05 Mpa)	Check sheet	Rework
				Pressure time		Engineering specification	Timer	100%	Each lot	1 Hr MIN	Process traveller	Rework
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again

PROCESS NO:	PROCESS NAME/ OPERATION DESCRIPTION	MACHINE DEVICE JIG, TOOL FOR MFG	CHARACTERISTICS		SPECIAL CHAR.	METHODS							REACTION PLAN
			PRODUCT	PROCESS		PRODUCT/ PROCESS SPECIFICATION/ TOLERANCE INTERNAL	EVALUATION MEASUREMENT TECHNIQUE	SAMPLE SIZE / QTY	SAMPLE FREQ	CONTROL METHODS	STANDARD		
28	Leak check II (Helium leak) /Inspection of fineleak. WI-PD-004 SOP-PD-ZSH* 5S-PD-ZSH* F-PD-ZSH*		Leak rate			Engineering specification	He leak machine	100%	Each lot	1.0×10^{-9} Pa m^3/s MAX	Process traveller		Discard
		Helium leak detector		Standard check		Working instruction	He calibrated leak	1 Time	1 Shift	MAX=4.8×10^{-8}Pa m^3/s MIN=0.8×10^{-8}Pa m^3/s	Check sheet		Calibrate again
				Lead time (Hold time)		Working instruction	Clock	100%	Each lot	5 min MIN	Process traveller		Re-pressure
				Inspection time		Working instruction	Clock	100%	Each lot	20 min MAX (including lead time)	Process traveller		Re-pressure
				Inspection qty.		Working instruction	Jig	1 Time	Each operation	100pcs MAX nearly equal/321 type	-		Rework
		(OK part stainless bowl) (NG part stainless bowl) (Helium leak bowl)		M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet		Cleaning again
				Cleanliness		Working instruction	Visual	1 Time	1Day	Cleancloth with alcohol	--		Cleaning again
				Cleanliness		Working instruction	Visual	1 Time	1Day	Cleancloth with alcohol	--		Cleaning again
				Cleanliness		Working instruction	Visual	1 Time	1Day	Cleancloth with alcohol	--		Cleaning again
29	Final check I /Inspection of electrical char. according to customer spec. WI-PD-004 SOP-PD-ZFT* 5S-PD-ZFT* F-PD-ZFT	Auto final check machine	Freq.			Engineering specification	S&A 250B	100%	Each lot	Each specification	Process traveller		Discard
			DLD			Engineering specification	S&A 250B	100%	Each lot	Each specification	Process traveller		Discard
			CI			Engineering specification	S&A 250B	100%	Each lot	Each specification	Process traveller		Discard
			Insulation			Engineering specification	Insulation tester	100%	Each lot	≥500MΩ at 100V DC	Process traveller		Discard
				Freq.&CI standard check		Working instruction	S&A 250B	1 Time	Each lot	Each specification	Process traveller		Calibrate again
				DLD setting		Engineering specification	S&A 250B	1 Time	Each lot	Each specification	Record		Discard
				Insulation standard check		Working instruction	Insulation tester	1 Time	Each lot	≥500MΩ at 100V DC	-		Discard
				Contact pin exchange		Working instruction	Visual	1 Time	1 Cycle	1 Cycle / 3 Days	Record		Rework
				Pin socket exchange		Working instruction	Visual	1 Time	1 Cycle	1 Cycle / 1 Month	Record		Rework
30	Temp. check /Inspection of Temp. char. according to customer spec. WI-PD-004 SOP-PD-ZTC* 5S-PD-ZTC* F-PD-ZTC*		Temp. char.			Customer specification	S&A W-2200	1 Time	Each lot	Each specification	Process traveller		Discard
		Temp. chamber machine		Inspection temp. setting		Engineering specification	S&A W-2200	1 Time	Each lot	Customer specification	Process traveller		Rework
				Contact plate		Working instruction	Visual	1 Time	Each operation	Inspection result	--		Rework
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--		Cleaning again
		(Product ring)		Deformation		Working instruction	Visual	1 Time	Each operation	Deformation	--		Repair or discard
				Cleanliness		Working instruction	Visual	1 Time	1 Month	Cleancloth with alcohol	--		Cleaning again
31	Thermistor bonding / Mounting Thermistor on the specified position of base back side by correct value of Solder paste.	Solder paste		Storage temp.		Engineering specification	Temp. monitor	1 Time	1 Day	0~10 °C/Refrigerator	Check sheet		Discard
				Storage time		Engineering specification	Expiration date label	1 Time	Each bottle	3 Months	Record		Discard
				Solder paste rest time after take out from Refrigerator		Working instruction	Timer	1 Time	Each operation	60 min MIN	Record		Discard
				Adhesive use time		Engineering specification	Visual	1 Time	8 ±1 Hours	--	Check sheet		Exchange solder paste
		Working table		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	-		Cleaning again
		Mounting machine		Mounting appearance		Engineering specification	CCD camera / Boundary sample	1 Time	Each Lot	100%	Process traveller		Discard
				Thermistor nozzle gap		Working instruction	Visual	1 Time	1 Shift	No Thermistor damaged	Check sheet		Adjust again
				Base nozzle gap		Working instruction	Visual	1 Time	1 Shift	No base crack	Check sheet		Adjust again
				Air pressure		Working instruction	Pressure gauge monitor	1 Time	1 Shift	0.20~0.60Mpa	Check sheet		Adjust again
				N2 pressure		Working instruction	Pressure gauge monitor	1 Time	1 Shift	0.20~0.40Mpa	Check sheet		Adjust again
				Base clip pressure		Working instruction	Pressure gauge monitor	1 Time	1 Shift	0.05~0.20Mpa	Check sheet		Adjust again
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet		Cleaning again
				Syringe & needle exchange		Working instruction	Visual	1 Time	8 ±1 Hours	--	Check sheet		Exchange adhesive
		(Bonding tray)		Deformation		Working instruction	Visual	1 Time	1 Month	--	--		Repair or discard
				Cleanliness		Working instruction	Visual	1 Time	1 Month	US alcohol	--		Cleaning again
		(Bonding magazine)		Deformation		Working instruction	Visual	1 Time	1 Month	--	--		Repair or discard
				Cleanliness		Working instruction	Visual	1 Time	1 Month	5S Picture	Check sheet		Cleaning again
32	Reflow / To detect the dust adhered on the blank surface. WI-PD-004 SOP-PD-ZRF* 5S-PD-ZRF* F-PD-ZRF*	Reflow machine		Temp.		Engineering specification	Temp. Meter	1 Time	1 Day	265±5 °C (10sec Max.), >220 °C (125±35sec)	Check sheet		Rework
								1 Time	3 Months	Temp. profile	Record		Rework
				Belt speed		Engineering specification	Speed monitor	1 Time	1 Day	EACH MACHINE	Check sheet		Rework
				Qty.		Working instruction	Visual	1 Time	Each operation	1Lot/1tray	Process traveller		Count again
				Standby time after reflow		Working instruction	Timer	1 Time	Each lot	4 hours TYP	Process traveller		Standby again
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet		Cleaning again
		(Reflow tray) (Reflow funnel)		Cleanliness		Working instruction	Visual	1 Time	Each operation	Cleancloth with alcohol	--		Cleaning again
				Cleanliness		Working instruction	Visual	1 Time	1 Day	Cleancloth with alcohol	--		Cleaning again
33	Final check II /Inspection of electrical char. according to customer spec. WI-PD-004 SOP-PD-ZFT* 5S-PD-ZFT* F-PD-ZFT	Auto final check & taping machine	Freq.			Engineering specification	S&A 250B	100%	Each lot	Each specification	Process traveller		Discard
			DLD		$ CTP	Engineering specification	S&A 250B	100%	Each lot	Each specification	Process traveller (P chart)		Discard
			CI			Engineering specification	S&A 250B	100%	Each lot	Each specification	Process traveller		Discard
			Insulation			Engineering specification	Insulation tester	100%	Each lot	≥500MΩ at 100V DC	Process traveller		Discard
				Freq.&CI standard check		Working instruction	S&A 250B	1 Time	Each lot	Each specification	Process traveller		Calibrate again
				DLD setting		Engineering specification	S&A 250B	1 Time	Each lot	Each specification	Record		Discard
				Insulation standard check		Working instruction	Insulation tester	1 Time	Each lot	≥500MΩ at 100V DC	-		Discard
				Contact pin exchange		Working instruction	Visual	1 Time	1 Cycle	1 Cycle / 3 Days	Record		Rework
				Pin socket exchange		Working instruction	Visual	1 Time	1 Cycle	1 Cycle / 1 Month	Record		Rework

PROCESS NO:	PROCESS NAME/ OPERATION DESCRIPTION	MACHINE DEVICE JIG, TOOL FOR MFG	CHARACTERISTICS		SPECIAL CHAR.	METHODS						REACTION PLAN
			PRODUCT	PROCESS		PRODUCT/ PROCESS SPECIFICATION/ TOLERANCE INTERNAL	EVALUATION MEASUREMENT TECHNIQUE	SAMPLE SIZE / QTY	SAMPLE FREQ	CONTROL METHODS	STANDARD	
34	Taping/ Taping GOOD product according to customer requirement and Appearance check WI-PD-004 SOP-PD-ZFT* 5S-PD-ZFT* F-PD-ZFT		Appearance			Customer specification	CCD camera / Boundary sample	100%	Each lot	--	Process traveller	Check again
			Taping strength			Engineering specification	Pulling tester	1 Time	1 Shift	20~60g	Check sheet	Temp. adjust
				Suction nozzle		Working instruction	Visual	1 Time	Each operation	Each machine	--	Rework
				Heater temp.		Working instruction	Temp. meter	1 Time	1 Shift	KDS/HELE: 145 ±10 °C	Check sheet	Temp. adjust
				Heater exchange		Working instruction	Visual	1 Time	1 Cycle	1 Cycle / 1 Month	Check sheet	Exchange
				Air pressure		Working instruction	Air pressure gauge	1 Time	1 Shift	0.30~0.60Mpa	Check sheet	Adjust pressure
				Heater position		Working instruction	Visual / Boundary sample	1 Time	Each exchange heater	--	Check sheet	Rework
				M/C cleaning		Working instruction	Visual	1 Time	1 Shift	5S Picture	Check sheet	Cleaning again
35	Taping check /Final appearance check for taping-finished product WI-PD-004 SOP-PD-ZTA* 5S-PD-ZTA* F-PD-ZTA* QA-BS-IK* QA-BS-AP016*		Appearance			Engineering specification	Magnifying glass (×3) / Boundary sample	100%	Each lot	--	Inspection record	Taping again
				Label confirmation		Customer specification	Visual	1 Time	Each label	100%	Process traveller	Exchange
		Working table		Cleanliness		Working instruction	Visual	1 Time	1 Shift	Cleancloth with alcohol	--	Cleaning again
36	OQC inspection /customer requirement inspection for customer satisfaction by QC WI-QA-OQC-002*		Electrical characteristics			Customer specification	Network analyzer	1 Time	Each lot	(Ac:Re)=(0:1) / AQL 0.10% Level II	Outgoing inspection record	Re-operation previous process
			Appearance			Customer specification	Magnifying glass (×3) / Boundary sample	1 Time	Each lot	(Ac:Re)=(0:1) / AQL 0.10% Level II		
			Leak			Engineering specification	FC-40 check	1 Time	Each lot	(Ac:Re)=(0:1) / AQL 0.10% Level II		
			Dimension			Customer specification	Digital caliper	1 Time	Each lot	(Ac:Re)=(0:1) / AQL 1.0% Level S-2		
			Label			Customer specification	Visual / Barcode reader	100%	Each lot	Each specification		
			Qty.			Customer specification	Visual	1 Time	Each lot	1 Reel / 1 Lot		
37	Packing to shipment/stock /Packaging&shipments meets customer spec. WI-PC-SHI-001		Packaging condition			Engineering specification	Packaging & Shipment reference	100%	Each lot	Each specification	Record	Packaging again

Special parameters characteristics to be controlled ($)

Analysis report of environment-related substances

Purpose	Approval	Approval	Written by	Confirmed by
Submitted Date	2014.02.20	Name	Kana Matsui	Kenji Nakazawa
Halogen Free	YES	Signature		
Phthalate Free	YES			
Beryllim Free	YES			
Sb2O3 Free	YES			
Nickel Free	Not Applicable (Internal parts)			

당사가 납품하는 납입품 및 당사 제조 공정상 사용되는 물질이 아래 기재된 사항과 같음을 증명합니다.

1. General Information

LGE Part No.	EAW62443401	Vendor Code		Supply to	
Class Name		Vendor Name (Local)	株式会社　大真空	Submitted Date	2014.02.20
Maker Part No.	1RAB26000AEA	Vendor Name (English)	DAISHINKU CORP.	Recorded by	Kana Matsui
Maker Part Name	Crystal Resonator DSR221STH 26.000MHz	Maker Name (Local)	株式会社 大真空		kankyou@kds.info
(Weight (g)	0.017723	Maker Name (English)	DAISHINKU CORP.		(81)79-425-6702

2. Analysis Information

Sub Part Name	Sub P/No.	Supplier	Weight (g)	Homogeneous Material Supplier	Homgeneous Material	Homogeneous Material Supplier	Main Material	Ratio (wt%)	Sample No.	RoHS						Halogen material		Nickel	Phthalates	Beryllium	Sb2O3	Exception	Remark	Judgment
										Pb	Cd	Hg	Cr+6	PBB	PBDE	Total Br.	Cl.	Ni.						
										100/500/800↓	10/75 ↓	500 ↓	500 ↓	500 ↓	500 ↓	700 ↓	900 ↓	0.5↓ [μg/cm²/week]	1000↓	1000↓	1000↓			
Crystal blank	-	Company A	0.000262	Company A	Quartz(SiO2)	Company A	SiO2	1.48%		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.D.	N.A.			OK
Base(Ceramic)	-	Company B	0.01034	Company B	Alumina ceramics	Company B	Al2O3	58.34%		N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D.	N.A.			OK
Base(Metalized)	-	Company B	0.00179	Company B	W, Mo	Company B	W	10.10%		N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D.	N.A.			OK
Base(Ni plating)	-	Company B	0.00028	Company B	Ep-NiCo	Company B	Ni	1.58%		9	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D.	N.A.			OK
Base(Au plating)	-	Company B	0.00008	Company B	Ep-Au	Company B	Au	0.45%		N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D.	N.A.			OK
Base(Seal ring)	-	Company B	0.00121	Company B	Kovar	Company B	Fe	6.83%		N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D.	N.A.			OK
Base(Silver metal)	-	Company B	0.00048	Company B	B-Ag85Cu	Company B	Ag	2.71%		N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D.	N.A.			OK
Lid(Kovar)	-	Company C	0.00272	Company C	Kovar	Company C	Fe	15.35%		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.	N.A.	N.D.	N.A.			OK
Lid(Ni plating)	-	Company C	0.00027	Company C	Ep-Ni	Company C	Ni	1.52%		N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D.	N.A.			OK
Inside electrode	-	Company D	0.000001	Company D	Au	Company D	Au	0.01%		N.D.	N.D.	N.D.	Negative	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.D.	N.A.			OK
Conducting adhesive agent	-	Company E	0.000017	Company E	Ag, Resin	Company E	Ag	0.10%		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.D.	N.A.			OK
Thermistor(Ceramic element)	-	Company F	0.000237	Company F	Oxide ceramics	Company F	Co3O4	1.34%		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.	N.A.	N.D.	N.A.			OK
Thermistor(Internal electrode)	-	Company F	0.000012	Company F	Refined Palladium (99.95)	Company F	Pd	0.07%		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.D.	N.A.			OK
Thermistor(Substrate electrode)	-	Company F	0.000011	Company F	Cu99	Company F	Cu	0.06%		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.	N.A.	N.D.	N.A.			OK
Thermistor(Intermediate electrode)	-	Company F	0.000005	Company F	Ni99	Company F	Ni	0.03%		N.D.	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D.	N.A.			OK
Thermistor(External electrode)	-	Company F	0.000005	Company F	Sn	Company F	Sn	0.03%		24	N.D.	N.D.	N.D.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D.	N.A.			OK
Solder	-	Company G	0.000003	Company G	Sn-Ag-Cu	Company G	Sn	0.02%		300	N.D.	N.D.	N.D.	N.A.	N.A.	N.D.	N.A.	N.A.	N.A.	N.D.	N.A.			OK

Note.
1) N.D. : Not Detected
2) N.A. : Not Applicable
3) Beryllium
-MSDS内 Beryllium含有 :含有量記入 (例 0.2~0.4%)
-MSDS内 Beryllium 未含有 : N.D.
4) Sb2O3 以外 Sb使用時
-精密分析成績書上 Sb or Sb2O3が 1000ppm以上検出される場合, Remarkに使用中の物質記録すること
(MSDS, Mill sheet, Material composition)証明データ必要
5) 除外事項に該当する場合、除外項目番号を必ず記入すること
-RoHS除外　：RoHS除外の "Exemption No."記入

Non-use Certificate

Ver 8.1

Purpose	For Approval		Submitted Date	2014 . 02 . 20	
Application Model		Halogen Free	Completed	Phthalate Free	Completed

Vendor Name	DAISHINKU CORP.	Approval	Written by	Confirmed by
Tel. Number	(81)79-425-6702	Name	Kana Matsui	Kenji Nakazawa
E-mail	kankyou@kds.info	Signature	K. Matsui	K. nakazawa

LGE P/No.	EAW62443401	Part Name	Crystal Resonator DSR221STH 26.000MHz
Maker P/No.	1RAB26000AEA	Factory	HARMONY ELECTRONICS (THAILAND)CO.,LTD.

This is to certify that materials used and contained in the materials and products that we supply to your company, meet the standards of the checked items listed below.

1. We meet the standards of LG Electronics DS Division for the major substances as below.

Restricted Substances		Limit Spec (ppm)	
		Product	Packaging / Label
Level A-I	Lead and its compounds	50 / 100 / 500 / 800	100 (Total of Pb,Cd,Hg,Cr+6)
	Cadmium and its compounds	5 / 30	
	Mercury and its compounds	50	
	Hexavalent chromium and its compounds	N.D. / 100	
	Polybrominated biphenyls (PBB)	500	N/A
	Polybrominated diphenylethers (PBDE)	500	
Level A-II	Bromine (Br) and its compounds	700	N/A
	Chlorine(Cl) and its compounds	700	N/A
	Phthalates(DEHP, DBP,BBP)	1000	1000
	All Other Phthalates(DIDP, DINP, DNOP and DIBP)	1000	1000
	Refer to 'Control list of Environment-Related Substances(Ver 8.1)' for other restricted substances.		

Cd : 1) 5 ppm : Plastic, Rubber, Paint, Ink, Painting(Metal, Plastic) 2) 30 ppm : Solder, Part Lead,Solder Ball, Inorganic material, Plating	Hg : 1) 50 ppm : All Parts
Pb : 1) 50 ppm : Plastic, Rubber, Paint, Ink, Painting(Metal, Plastic) 2) 500 ppm : Inorganic material / Plating, Part Lead 3) 800 ppm : Solder, Solder Ball 4) 100 ppm : Others	Cr+6 : 1) N.D.(Not Detected) : Metal and plastic plating 2) 100 ppm : Others(Plastic, Rubber, Paint, Ink, Metal, etc.)
PBB/PBDE 1) Halogen free parts : can be substituted by Br test report But in case of Spec(500ppm) over, need to submit the PBB/PBDE test report 2) non-Halogen free parts : need to submit the PBB/PBDE test	Halogen (Br, Cl) : 1) 700 ppm : All Parts of Halogen free Models which are designated by LGE DS Div. 2) Br + Cl : 1,000ppm 3) Test exemption material : Metal, Metal Plating, Glass, Ceramic,
Phthalates 1) All parts should phase out all kinds of Phthalates by end of 2010 except Cable parts. 2) Cable parts(except FFC, FPC) should phase out Phthalate 3 items(DEHP, DBP, BBP) by May. 2010 and all kinds of Phthalates by end of 2012 3) Mendatory phthalate test items and Spec : Phthalates 7 items(DEHP, DBP, BBP, DINP, DIDP, DNOP, DIBP) including Cable parts,	

2. Maximum heat-resisting temperature and time ※ Records are requested if they are parts to be actually installed on the PCB (Printed Circuit Board)

Maximum heat-resisting temperature: 260 ℃ Maximum heat-resisting time: 10 sec

3. Pb-Free soldering (all solder cream, bars and wires included) is available to apply.

Note.
1. All the contents written on these documents must be created on the basis of facts, and cooperating suppliers must submit the data immediately whenever LG Electronics (DS Division / HZ Factory) requests.
2. In the case that these documents are used for approval purposes, cooperating suppliers must submit the sample on the request. For the purpose of mass production, it must be submitted at the time of delivering the first product.
3. Limit spec of DS Division and HZ Factory is different from the common spec of LG Electronics by customer requirement spec.
4. Using in RoHS exemptions items defined by 'Manual for Preparation Environmental Regulations' is permitted.

Control list of Environment-Related Substances

Ver. 8.1

Purpose	For Approval		Submitted Date	2014 . 02 . 20	
Application Model		Halogen Free	Completed	Phthalate Free	Completed

Vendor Name	DAISHINKU CORP.	Approval	Written by	Confirmed by
Tel. Number	(81)79-425-6702	Name	Kana Matsui	Kenji Nakazawa
E-mail	kankyou@kds.info	Signature	K. Matsui	K. nakazawa

LGE P/No.	EAW62443401	Part Name	Crystal Resonator DSR221STH 26.000MHz
Maker P/No.	1RAB26000AEA	Factory	HARMONY ELECTRONICS (THAILAND)CO.,LTD.

This is to certify that materials used and contained in the materials and products that we supply to your company, meet the standards of the checked items listed below.

Classification	Substances	Spec(ppm)	Spec Over		
			Yes	No	Exception
Level A-I (Prohibited to Use)	Lead and its compounds	Reference : Non-use Certificate Sheet		V	
	Cadmium and its compounds			V	
	Mercury and its compounds			V	
	Hexavalent chromium and its compounds			V	
	Polybrominated biphenyls (PBB)			V	
	Polybrominated diphenylethers (PBDE)			V	
Level A-II (Prohibited to Use)	Polychlorinated biphenyls (PCB)	N.D.		V	
	Polychlorinated naphthalenes (PCN)	N.D.		V	
	Polychlorinated terphenyls (PCT)	N.D.		V	
	Short-chain Chlorinated paraffins (SCCP)	N.D.		V	
	Midium-chain Chlorinated paraffins (MCCP)	1,000		V	
	Asbestos and its compounds	N.D.		V	
	Ozone Depleting Substances	N.D.		V	
	Azo compounds [5]	N.D.		V	
	Nickel and its compounds [6]	N.D.		V	
	Specific Organic tin compounds	N.D.		V	
	Arsenic and its compounds [7]	100		V	
	Formaldehydes	N.D.		V	
	Perfluorooctane sulfonates(PFOS) [8]	5/1,000		V	
	Perfluorooctanoic Acid(PFOA)	50		V	
	Pentachlorophenoldl(PCP)	N.D.		V	
	Ugilec 121,141,DBBT	N.D.		V	
	Phthalates(DEHP, DBP,BBP) [9]	1000		V	
	All Other Phthalates(DIDP, DINP, DNOP and DIBP) [9]	1000		V	
	Polyvinyl chloride (PVC) [10]	N.D.		V	
	Dioxins / furans	N.D.		V	
	Radioactive Substances	(O,X)		V	
	Bromine (Br) and its compounds [11]	700		V	
	Chlorine(Cl) and its compounds [11]	700		V	
	Polycyclic-aromatic hydrocarbons(PAHs) [12]	N.D.		V	
	Dimethylfumarate (DMF)	N.D.		V	
	Antimony and its compounds [13]	1000		V	
	Antimony Trioxide [14]	1000		V	
	Beryllium and its compounds [13]	200		V	
	Beryllium Oxide [13]	N.D.		V	
	Red Phosphorus	1000		V	
Level B (to be supervised and reduced)	Selenium and its compounds	1000		V	
	Bismuth and its compounds	1000		V	
	Volatile Organic Compund [15]	1000		V	
	4.4'-isopropylidenediphenol (Bisphenol-A)	25		V	
	Trichlosan	N.D.		V	

Classification	CAS No.	Substances	Inclusion	
			Yes	No
	101-77-9	4,4'- Diaminodiphenylmethane		V
	7646-79-9	Cobalt dichloride		V
	7789-12-0	Sodium dichromate, dihydrate		V
	25637-99-4	Hexabromocyclododecane (HBCDD)		V
	85535-84-8	Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins_SCCP		V
	56-35-9	Bis(tributyltin)oxide(TBTO)		V

REACH SVHC 1st Candidate List	84-74-2	Dibutyl phthalate (DBP)		V
	85-68-7	Benzyl butyl phthalate (BBP)		V
	117-81-7	Bis (2-ethyl(hexyl)phthalate) (DEHP)		V
	1303-28-2	Diarsenic pentaoxide		V
	1327-53-3	Diarsenic trioxide		V
	7784-40-9	Lead hydrogen arsenate		V
	15606-95-8	Triethyl arsenate		V
	120-12-7	Anthracene		V
	81-15-2	5-tert-butyl-2,4,6-trinitro-m-xylene (musk xylene)		V
REACH SVHC 2nd Candidate List	90640-80-5	Anthracene oil		V
	91995-17-4	Anthracene oil, anthracene paste, distn. lights		V
	91995-15-2	Anthracene oil, anthracene paste, anthracene fraction		V
	90640-82-7	Anthracene oil, anthracene-low		V
	90640-81-6	Anthracene oil, anthracene paste		V
	79-06-1	acrylamide		V
	650-017-00-	Aluminiosilicate, Refractory Ceramic Fibres		V
	650-017-00-	Zirconia Aluminosilicate, Refractory Ceramic Fibres		V
	121-14-2	2,4-Dinitrotoluene		V
	7758-97-6	Lead chromate		V
	12656-85-8	Lead chromate molybdate sulphate red (C.I. Pigment Red 104)***		V
	1344-37-2	Lead sulfochromate yellow (C.I. Pigment Yellow 34)		V
	65996-93-2	Coal Tar pitch, high temeperature		V
	115-96-8	Tris(2-chloroethyl)phosphate		V
	84-69-5	Diisobutyl phthalate(DIBP)		V
REACH SVHC 3rd Candidate List	79-01-06	Trichloroethylene		V
	10043-35-3/11113-	Boric acid		V
	1303-96-4/1330-	Disodium tetraborate, anhydrous		V
	12267-73-1	Tetraboron disodium heptaoxcide, hydrate		V
	7775/11/3	Sodium chromate		V
	7789-00-6	Potassium chromate		V
	7789/9/5	Ammonium dichromate		V
	7778-50-9	Potassium dichromate		V
REACH SVHC 4th Candidate List	10124-43-3	Cobalt(II) sulphate		V
	10141-05-6	Cobalt(II) dinitrate		V
	513-79-1	Cobalt(II) carbonate		V
	71-48-7	Cobalt(II) diacetate		V
	109-86-4	2-Methoxyethanol		V
	110-80-5	2-Ethoxyethanol		V
	1333-82-0	Chromium trioxide		V
	7738-94-5 13530-68-2	Acid generated from chromium trioxide and their oligomer Group containing: Chromic acid Dichromic acid Oligomer of chronic acid and dichromic acid		V
REACH SVHC 5th Candidate List	111-15-9	2-ethoxyethyl acetate(2EEA)		V
	7789/6/2	Strontium chromate		V
	68515-42-4	1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters(DHNUP : Di (heptyl, nonyl, undecyl		V
	302-01-2	Hydrazine		V
	872-50-4	1-methyl-2-pyrrolidone(NMP)		V
	96-18-4	1,2,3-trichloropropane		V
	71888-89-6	1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich (DIHP : Diisoheptyl phthalate)		V

Note.
1. All the contents written on these documents must be created on the basis of facts, and cooperating suppliers must submit the data immediately whenever LG Electronics (DS Division / HZ Factory) requests.
2. In the case that these documents are used for approval purposes, cooperating suppliers must submit the sample on the request. For the purpose of mass production, it must be submitted at the time of delivering the first product.
3. Limit spec of DS Division and HZ Factory is different from the common spec of LG Electronics by customer requirement spec.
4. Using in RoHS exemptions items defined by 'Manual for Preparation Environmental Regulations' is permitted.
5. Textiles and leather(such as carrying cases and protective covers), may come in prolonged direct contact with exposed skin.
6. Finishes for the external surface of any portable electronic product designed to be frequently handled or carried by the user.
7. All application except semiconductor substrate(GaAs), flame retardant.
8. Preparation : 5ppm, Parts :1,000ppm
9. All parts should phase out all kinds of Phthalates by end of 2010 except Cable parts.
   Cable parts(except FFC, FPC) should phase out Phthalate 3 items(DEHP, DBP, BBP) by May. 2010 and all kinds of Phthalates by end of 2012.
   Refer to Non-use certificate for detail spec and document preparation.
10. All Package, outer plastic parts and all Parts of Halogen free Models which are designated by LGE DS Div.
11. All Parts of Halogen free Models which are designated by LGE DS Div, The parts of 700~900ppm should be discussed with LGE DS Div.
    Total Halogen(Br+Cl):1,000ppm, Refer to Non-use certificate for detail spec and document preparation.
12. May come in prolonged direct contact with exposed skin.
13. All parts of new products which will be launched on the market after end of 2012 should phase out Antimony and Beryllium.
14. LGE DS Div. has restricted to use antimony trioxide to Halogen free model from the year 2008.
15. Main Materials : Toluene, Bezene, Methyl Bromide, Xylene, Naphthalene, Formaldehydes, and so on
16. The detected value has to be input into HSMS if there is any content.

SVHC Warranty (Confidential)

Date of submission : 2014.2.20.

DAISHINKU CORP. company hereby warrants that certain homogeneous materials which are impossible to open their chemical composition because of trade secret do not contain more than 0.1% by weight per homogeneous materials (or Article) of any substance on the SVHC[1] candidate list.

Supplier Information			
Supplier code		Presenter	Kana Matsui
Contact number	(81)79-425-6702	E-Mail	kankyou@kds.info
Supplier name	DAISHINKU CORP.		
Maker name	DAISHINKU CORP.		

Guaranteed Homogeneous material	
Name	※Please make a list of all warranted parts on Appendix Ⅱ

SVHC List
※ Please find SVHC list on Appendix I

Signature : K. nakazawa.

Name : Kenji Nakazawa

Position : General Manager of Quality Assurance Div.

1) SVHC : Substances of Very High Concern

LG Electronics

Appendix I

SVHC List

Last Updated : December.2012.

Substance Name	CAS No.	EC No.
Triethyl arsenate	15606-95-8	427-700-2
Anthracene	120-12-7	204-371-1
4,4'- Diaminodiphenylmethane (MDA)	101-77-9	202-974-4
Dibutyl phthalate (DBP)	84-74-2	201-557-4
Cobalt dichloride	7646-79-9	231-589-4
Diarsenic pentaoxide	1303-28-2	215-116-9
Diarsenic trioxide	1327-53-3	215-481-4
Sodium dichromate	7789-12-0 10588-01-9	234-190-3
5-tert-butyl-2,4,6-trinitro-m-xylene (musk xylene)	81-15-2	201-329-4
Bis (2-ethylhexyl)phthalate(DEHP)	117-81-7	204-211-0
Hexabromocyclododecane (HBCDD) - Alpha-hexabromocyclododecane - Beta-hexabromocyclododecane - Gamma-hexabromocyclododecane	25637-99-4, 3194-55-6 - 134237-51-7 - 134237-50-6 - 134237-52-8	247-148-4 221-695-9
Bis(tributyltin)oxide (TBTO)	56-35-9	200-268-0
Lead hydrogen arsenate	7784-40-9	232-064-2
Benzyl butyl phthalate (BBP)	85-68-7	201-622-7
Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins)	85535-84-8	287-476-5
Anthracene oil	90640-80-5	292-602-7
Anthracene oil, anthracene paste, distn. Lights	91995-17-4	295-278-5
Anthracene oil, anthracene paste, anthracene fraction	91995-15-2	295-275-9
Anthracene oil, anthracene-low	90640-82-7	292-604-8
Anthracene oil, anthracene paste	90640-81-6	292-603-2
Diisobutyl phthalate	84-69-5	201-553-2
2,4-Dinitrotoluene	121-14-2	204-450-0
coal tar pitch, high temperature	65996-93-2	266-028-2
tris(2-chloroethyl)phosphate	115-96-8	204-118-5

※ This SVHC list will be updated irregularly according to the candidate list from ECHA and customers.

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Appendix I

SVHC List

Last Updated : December.2012.

Substance Name	CAS No.	EC No.
Aluminosilicate, Refratory Ceramic Fibres	-	Index no. 650-017-00-8
Zirconia Aluminosilicate, Refratory Ceramic Fibres	-	Index no. 650-017-00-8
Lead sulfochromate yellow (C.I. Pigment Yellow 34)	1344-37-2	215-693-7
Lead chromate molybdate sulfate red (C.I. Pigment Red 104)	12656-85-8	235-759-9
Lead chromate	7758-97-6	231-846-0
Acrylamide	79-06-1	201-173-7
Trichloroethylene	79-01-06	201-167-4
Boric acid	10043-35-3,	233-139-2
	11113-50-1	234-343-4
Disodium tetraborate, anhydrous	1303-96-4	215-540-4
	1330-43-4	
	12179-04-3	
Tetraboron disodium heptaoxide, hydrate	12267-73-1	235-541-3
Sodium chromate	7775-11-03	231-889-5
Potassium chromate	7789-00-6	232-140-5
Ammonium dichromate	7789-09-05	232-143-1
Potassium dichromate	7778-50-9	231-906-6
Cobalt(II) sulphate	10124-43-3	233-334-2
Cobalt(II) dinitrate	10141-05-6	233-402-1
Cobalt(II) carbonate	513-79-1	208-169-4
Cobalt(II) diacetate	71-48-7	200-755-8
2-Methoxyethanol	109-86-4	203-713-7
2-Ethoxyethanol	110-80-5	203-804-1
Chromium trioxide	1333-82-0	215-607-8
Acids generated from chromium trioxide and their oligomers: Chromic acid Dichromic acid Oligomers of chromic acid and dichromic acid	 7738-94-5 13530-68-2 -	231-801-5 236-881-5 -

※ This SVHC list will be updated irregularly according to the candidate list from ECHA and customers.

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Appendix I

SVHC List

Last Updated : December.2012.

Substance Name	CAS No.	EC No.
2-ethoxyethyl acetate	111-15-9	203-839-2
strontium chromate	7789-06-02	232-142-6
1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters	68515-42-4	271-084-6
Hydrazine	7803-57-8 302-01-2	206-114-9
1-methyl-2-pyrrolidone	872-50-4	212-828-1
1,2,3-trichloropropane	96-18-4	202-486-1
1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich	71888-89-6	276-158-1
4-(1,1,3,3-tetramethylbutyl)phenol, (4-tert-Octylphenol)	140-66-9	205-426-2
2-Methoxyaniline; o-Anisidine	90-04-0	201-963-1
Arsenic acid	7778-39-4	231-901-9
Calcium arsenate	7778-44-1	231-904-5
Trilead diarsenate	3687-31-8	222-979-5
1,2-Dichloroethane; ethylene dichloride	107-06-2	203-458-1
Bis(2-methoxyethyl) ether	111-96-6	203-924-4
Bis(2-methoxyethyl) phthalate	117-82-8	204-212-6
N,N-dimethylacetamide (DMAC)	127-19-5	204-826-4
Lead diazide; Lead azide	13424-46-9	236-542-1
Lead styphnate	15245-44-0	239-290-0
2,2'-dichloro-4,4'-ethylenedianiline (MOCA)	101-14-4	202-918-9
Dichromium tris(chromate)	24613-89-6	246-356-2
Potassium hydroxyoctaoxodizincatedichromate	11103-86-9	234-329-8
Pentazinc chromate octahydroxide	49663-84-5	256-418-0
Phenolphthalein	77-09-8	201-004-7
Lead dipicrate	6477-64-1	229-335-2
Formaldehyde, oligomeric reaction products with aniline (technical MDA)	25214-70-4	500-036-1

※ This SVHC list will be updated irregularly according to the candidate list from ECHA and customers.

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Appendix I

SVHC List

Last Updated : December.2012.

Substance Name	CAS No.	EC No.
Zirconia Aluminosilicate Refractory Ceramic Fibres	-	-
Aluminosilicate Refractory Ceramic Fibres	-	-
[4-[4,4'-bis(dimethylamino) benzhydrylidene]cyclohexa-2,5-dien-1-ylidene]dimethylammonium chloride (C.I. Basic Violet 3) [with ≥ 0.1% of Michler's ketone (EC No. 202-027-5) or Michler's base (EC No. 202-959-2)]	548-62-9	208-953-6
1,3,5-tris[(2S and 2R)-2,3-epoxypropyl]-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione (β-TGIC)	59653-74-6	423-400-0
1,2-bis(2-methoxyethoxy)ethane (TEGDME; triglyme)	112-49-2	203-977-3
4,4'-bis(dimethylamino)-4''-(methylamino)trityl alcohol [with ≥ 0.1% of Michler's ketone (EC No. 202-027-5) or Michler's base (EC No. 202-959-2)]	561-41-1	209-218-2
Lead(II) bis(methanesulfonate)	17570-76-2	401-750-5
1,2-dimethoxyethane; ethylene glycol dimethyl ether (EGDME)	110-71-4	203-794-9
Diboron trioxide	1303-86-2	215-125-8
α,α-Bis[4-(dimethylamino)phenyl]-4 (phenylamino)naphthalene-1-methanol (C.I. Solvent Blue 4) [with ≥ 0.1% of Michler's ketone (EC No. 202-027-5) or Michler's base (EC No. 202-959-2)]	6786-83-0	229-851-8
1,3,5-Tris(oxiran-2-ylmethyl)-1,3,5-triazinane-2,4,6-trione (TGIC)	2451-62-9	219-514-3
4,4'-bis(dimethylamino)benzophenone (Michler’s ketone)	90-94-8	202-027-5
N,N,N',N'-tetramethyl-4,4'-methylenedianiline (Michler’s base)	101-61-1	202-959-2
[4-[[4-anilino-1-naphthyl][4-(dimethylamino)phenyl]methylene]cyclohexa-2,5-dien-1-ylidene] dimethylammonium chloride (C.I. Basic Blue 26) [with ≥ 0.1% of Michler's ketone (EC No. 202-027-5) or Michler's base (EC No. 202-959-2)]	2580-56-5	219-943-6
Formamide	75-12-7	200-842-0

※ This SVHC list will be updated irregularly according to the candidate list from ECHA and customers.

Appendix I

SVHC List

Last Updated : December.2012.

Substance Name	CAS No.	EC No.
Pyrochlore, antimony lead yellow	8012-00-8	232-382-1
6-methoxy-m-toluidine (p-cresidine)	120-71-8	204-419-1
Henicosafluoroundecanoic acid	2058-94-8	218-165-4
Hexahydromethylphthalic anhydride [1], Hexahydro-4-methylphthalic anhydride [2], Hexahydro-1-methylphthalic anhydride [3], Hexahydro-3-methylphthalic anhydride [4] [The individual isomers [2], [3] and [4] (including their cis- and trans- stereo isomeric forms) and all possible combinations of the isomers [1] are covered by this entry]	25550-51-0, 19438-60-9, 48122-14-1, 57110-29-9	247-094-1, 243-072-0, 256-356-4, 260-566-1
Cyclohexane-1,2-dicarboxylic anhydride [1], cis-cyclohexane-1,2-dicarboxylic anhydride [2], trans-cyclohexane-1,2-dicarboxylic anhydride [3] [The individual cis- [2] and trans- [3] isomer substances and all possible combinations of the cis- and trans-isomers [1] are covered by this entry]	85-42-7, 13149-00-3, 14166-21-3	201-604-9, 236-086-3, 238-009-9
Dibutyltin dichloride (DBTC)	683-18-1	211-670-0
Lead bis(tetrafluoroborate)	13814-96-5	237-486-0
Lead dinitrate	10099-74-8	233-245-9
Silicic acid, lead salt	11120-22-2	234-363-3
4-Aminoazobenzene	60-09-3	200-453-6
Lead titanium zirconium oxide	12626-81-2	235-727-4
Lead monoxide (lead oxide)	1317-36-8	215-267-0
o-Toluidine	95-53-4	202-429-0
3-ethyl-2-methyl-2-(3-methylbutyl)-1,3-oxazolidine	143860-04-2	421-150-7
Silicic acid (H2Si2O5), barium salt (1:1), lead-doped [with lead (Pb) content above the applicable generic concentration limit for 'toxicity for reproduction' Repr. 1A (CLP) or category 1 (DSD); the substance is a member of the group entry of lead compounds, with index number 082-001-00-6 in Regulation (EC) No 1272/2008]	68784-75-8	272-271-5
Trilead bis(carbonate)dihydroxide	1319-46-6	215-290-6
Furan	110-00-9	203-727-3
N,N-dimethylformamide	68-12-2	200-679-5
4-(1,1,3,3-tetramethylbutyl)phenol, ethoxylated [covering well-defined substances and UVCB substances, polymers and homologues]	2315-67-5, 2315-61-9, 9002-93-1, 2497-59-8, etc.	-

※ This SVHC list will be updated irregularly according to the candidate list from ECHA and customers.

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Appendix I

SVHC List

Last Updated : December.2012.

Substance Name	CAS No.	EC No.
4-Nonylphenol, branched and linear [substances with a linear and/or branched alkyl chain with a carbon number of 9 covalently bound in position 4 to phenol, covering also UVCB- and well-defined substances which include any of the individual isomers or a combination thereof]	84852-15-3, 26543-97-5, 104-40-5, 17404-66-9, 30784-30-6, 52427-13-1, 186825-36-5, 142731-63-3, etc.	284-325-5, 247-770-6, 203-199-4, 241-427-4, 250-339-5, 257-907-1, - -, etc.
4,4'-methylenedi-o-toluidine	838-88-0	212-658-8
Diethyl sulphate	64-67-5	200-589-6
Dimethyl sulphate	77-78-1	201-058-1
Lead oxide sulfate	12036-76-9	234-853-7
Lead titanium trioxide	12060-00-3	235-038-9
Acetic acid, lead salt, basic	51404-69-4	257-175-3
[Phthalato(2-)]dioxotrilead	69011-06-9	273-688-5
Bis(pentabromophenyl) ether (decabromodiphenyl ether; DecaBDE)	1163-19-5	214-604-9
N-methylacetamide	79-16-3	201-182-6
Dinoseb (6-sec-butyl-2,4-dinitrophenol)	88-85-7	201-861-7
1,2-Diethoxyethane	629-14-1	211-076-1
Tetralead trioxide sulphate	12202-17-4	235-380-9
N-pentyl-isopentylphthalate	776297-69-9	-
Dioxobis(stearato)trilead	12578-12-0	235-702-8
Tetraethyllead	78-00-2	201-075-4
Pentalead tetraoxide sulphate	12065-90-6	235-067-7
Pentacosafluorotridecanoic acid	72629-94-8	276-745-2
Tricosafluorododecanoic acid	307-55-1	206-203-2
Heptacosafluorotetradecanoic acid	376-06-7	206-803-4
1-bromopropane (n-propyl bromide)	106-94-5	203-445-0
Methoxyacetic acid	625-45-6	210-894-6

※ This SVHC list will be updated irregularly according to the candidate list from ECHA and customers.

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Appendix I

SVHC List

Last Updated : December.2012.

Substance Name	CAS No.	EC No.
4-methyl-m-phenylenediamine (toluene-2,4-diamine)	95-80-7	202-453-1
Methyloxirane (Propylene oxide)	75-56-9	200-879-2
Trilead dioxide phosphonate	12141-20-7	235-252-2
o-aminoazotoluene	97-56-3	202-591-2
1,2-Benzenedicarboxylic acid, dipentylester, branched and linear	84777-06-0	284-032-2
4,4'-oxydianiline and its salts	101-80-4	202-977-0
Orange lead (lead tetroxide)	1314-41-6	215-235-6
Biphenyl-4-ylamine	92-67-1	202-177-1
Diisopentylphthalate	605-50-5	210-088-4
Fatty acids, C16-18, lead salts	91031-62-8	292-966-7
Diazene-1,2-dicarboxamide (C,C'-azodi(formamide))	123-77-3	204-650-8
Sulfurous acid, lead salt, dibasic	62229-08-7	263-467-1
Lead cyanamidate	20837-86-9	244-073-9

※ This SVHC list will be updated irregularly according to the candidate list from ECHA and customers.

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Appendix Ⅱ

Warranted Parts List

LGE Part No.	Part Name	Sub Part Name	Homogeneous Material
EAW62443401	DSR221STH 26.000MHz	Crystal blank	Quartz(SiO2)
		Base(Ceramic)	Alumina ceramics
		Base(Metalized)	W, Mo
		Base(Ni plating)	Ep-NiCo
		Base(Au plating)	Ep-Au
		Base(Seal ring)	Kovar
		Base(Silver metal)	B-Ag85Cu
		Lid(Kovar)	Kovar
		Lid(Ni plating)	Ep-Ni
		Inside electrode	Au
		Conducting adhesive agent	Ag, Resin
		Thermistor(Ceramic element)	Oxide ceramics
		Thermistor(Internal electrode)	Refined Palladium（99.95)
		Thermistor(Substrate electrode)	Cu99
		Thermistor(Intermediate electrode)	Ni99
		Thermistor(External electrode)	Sn
		Solder	Sn-Ag-Cu

Prepared for:

LG Electronics Inc.

Report No. R14NX09401

Reliability Test Data

Product:Crystal Resonator

Type : DSR221STH 26.000MHz

RoHS Compliant Part
JEITA : Phase 3A

(HARMONY THAILAND)

Date: ***Feb. 17, 2014***

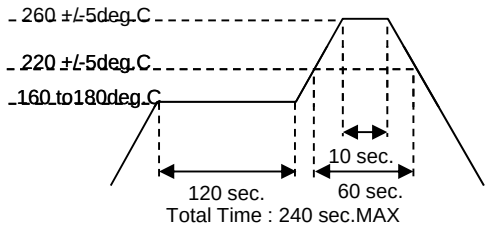
Daishinku Corporation

Quality Assurance Div.

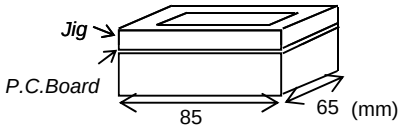
Akihiro Homma / Senior Manager

TEST PROCEDURES AND RESULTS

(Pre-treatment)

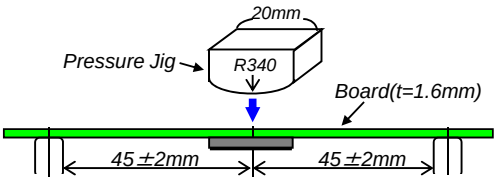
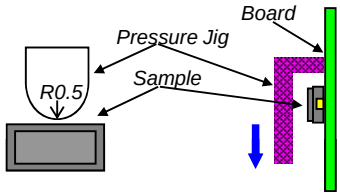
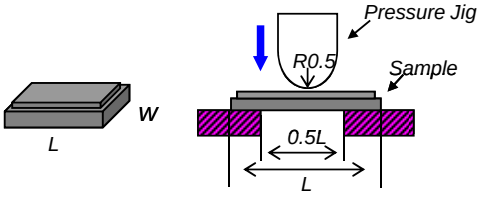
No.	TEST ITEM	TEST PROCEDURES	REQUIREMENT	RESULT	PAGE
1	Resistance to Soldering Heat (Reflow)	The following reflow shall be performed(3 times)  Total Time : 240 sec.MAX	Freq.variation delta F/F=+/- 2 ppm Max ESR variation delta ESR=+/- 15 % Max or +/- 2 ohm Max	r/n = 0/20 Passed	1

(Mechanical Characteristics)

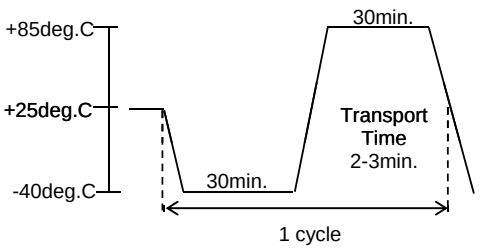
No.	TEST ITEM	TEST PROCEDURES	REQUIREMENT	RESULT	PAGE
2	Shock	<Drop > Mounting on the set or test fixture. Total Weight 100g Height 150cm Test cycle 3cycles Direction X,Y,Z-6 directions Flooring material Concrete  	Freq.variation delta F/F=+/- 2 ppm Max ESR variation delta ESR=+/- 15 % Max or +/- 2 ohm Max	r/n = 0/20 Passed	1
		<Shock(Pulse)> Acceleration 1000m/s^2 Duration 6ms Test cycle 3times/each Direction Direction X,Y,Z-6 directions	Freq.variation delta F/F=+/- 2 ppm Max ESR variation delta ESR=+/- 15 % Max or +/- 2 ohm Max	r/n = 0/20 Passed	1
3	Vibration	Supplyng following vibration ; Sweep range 10Hz to 500Hz to 10Hz Sweep speed 11min./cycle Amplitude 1.5mm(10 to 55Hz) Acceleration 100m/s^2 (55 to 500Hz) Direction X,Y,Z-3 directions Test time 2hours/direction	Freq.variation delta F/F=+/- 2 ppm Max ESR variation delta ESR=+/- 15 % Max or +/- 2 ohm Max	r/n = 0/20 Passed	1
4	Sealing Tightness	<Gross leak > Solution Chlorofluorocarbon Temp. +125+/-5 deg.C Time 3min.	No continuous air bubbles.	r/n = 0/20 Passed	-
		<Fine leak> It shall be measured by the helium leak detector.	2.0 E-9 Pa.m^3/sec. Max	r/n = 0/20 Passed	3
5	Solderability	<Solder bath method > After applying rosin flux.Dipping in molten solder in tank as follows; Soldering temp. 245+/-5 deg.C Duration 3sec. Flux NA-200(rosin flux) Solder Sn3Ag0.5Cu	A new uniform coating of solder shall cover a minimum of 95% of the surface being immersed.	r/n=0/20 Passed	-
6	Resistance to Soldering Heat	<Solder iron> Bit 3.0 phi Bit temp. 350+/-10deg.C Time 3sec. each terminal	Freq.variation delta F/F=+/- 2 ppm Max ESR variation delta ESR=+/- 15 % Max or +/- 2 ohm Max	r/n = 0/20 Passed	1

TEST PROCEDURES AND RESULTS

(Mechanical Characteristics)

No.	TEST ITEM	TEST PROCEDURES	REQUIREMENT	RESULT	PAGE
7	Board Bending Strength	Mount a sample on board. Apply pressure as following. Bend width 3mm Time 5sec. Pressure speed 1mm/sec. 	Freq.variation delta F/F=+/- 2 ppm Max ESR variation delta ESR=+/- 15 % Max or +/- 2 ohm Max	r/n = 0/20 Passed	1
8	Shear	Mount a sample on the circuit board apply pressure vertically to the side of specimen attached to the circuit board with the pressure jig. Pressure:10N for 10 +/- 1sec. 	Freq.variation delta F/F=+/- 2 ppm Max ESR variation delta ESR=+/- 15 % Max or +/- 2 ohm Max	r/n = 0/20 Passed	2
9	Body Strength	Apply pressure to the center of body with the R0.5 pressure jig. Pressure: 5N for 10 +/- 1sec. 	Freq.variation delta F/F=+/- 2 ppm Max ESR variation delta ESR=+/- 15 % Max or +/- 2 ohm Max	r/n = 0/20 Passed	2

(Environmental Characteristics)

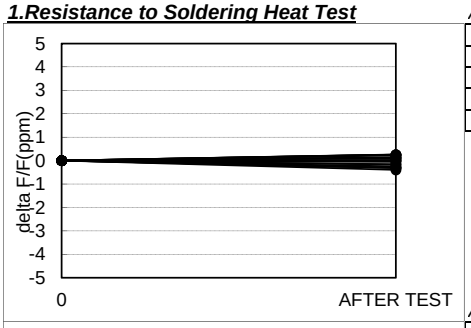
No.	TEST ITEM	TEST PROCEDURES	REQUIREMENT	RESULT	PAGE
10	Low Temperature Storage	Temp. -40+/- 3 deg.C Duration 240h	Freq.variation delta F/F=+/- 2 ppm Max ESR variation delta ESR=+/- 15 % Max or +/- 2 ohm Max	r/n=0/20 Passed	2
11	Humidity	Temp. +85+/- 2 deg.C Humidity 85+/-5%RH Duration 240h	Freq.variation delta F/F=+/- 2 ppm Max ESR variation delta ESR=+/- 15 % Max or +/- 2 ohm Max	r/n=0/20 Passed	2
12	High Temperature Storage	Temp. +85+/- 2 deg.C Duration 240h	Freq.variation delta F/F=+/- 2 ppm Max ESR variation delta ESR=+/- 15 % Max or +/- 2 ohm Max	r/n=0/20 Passed	2
13	Temperature Cycle	1000 cycles of Temperature 	Freq.variation delta F/F=+/- 2 ppm Max ESR variation delta ESR=+/- 15 % Max or +/- 2 ohm Max	r/n=0/20 Passed	2

* No.2,3,10-13 are tested after pretreatment(Reflow)

* ESR(Equivalent Series Resistance)=CI

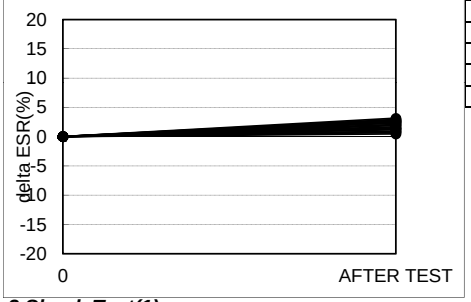
DSR221STH 26.000MHz (RoHS Compliant Part)
(HARMONY THAILAND)

1.Resistance to Soldering Heat Test



AFTER TEST

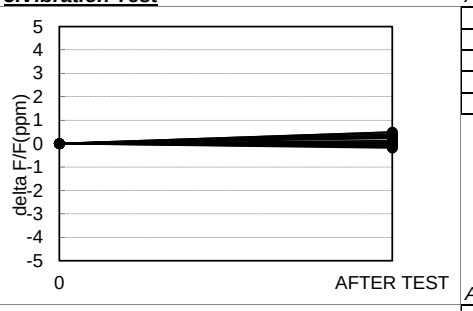
delta F/F(ppm)	
X-bar	-0.01
3S	0.66
MAX	0.3
MIN	-0.4



AFTER TEST

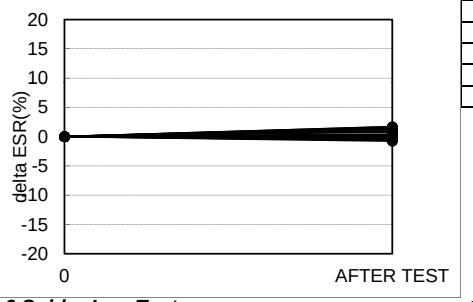
delta ESR(%)	
X-bar	1.86
3S	2.42
MAX	3.1
MIN	0.5

3.Vibration Test



AFTER TEST

delta F/F(ppm)	
X-bar	0.16
3S	0.64
MAX	0.5
MIN	-0.2



AFTER TEST

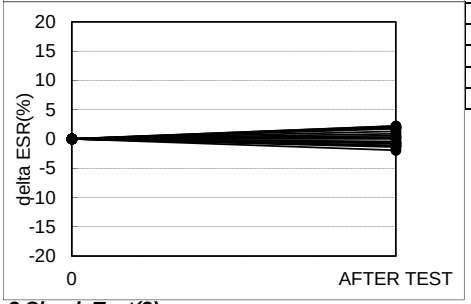
delta ESR(%)	
X-bar	0.54
3S	2.58
MAX	1.7
MIN	-0.8

2.Shock Test(1)



AFTER TEST

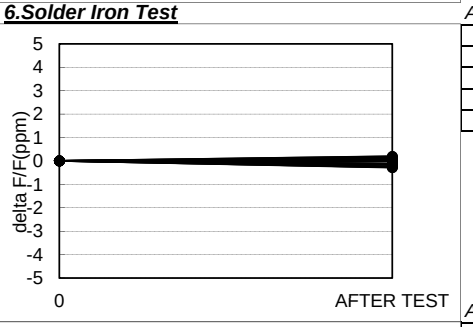
delta F/F(ppm)	
X-bar	0.37
3S	1.10
MAX	1.0
MIN	-0.2



AFTER TEST

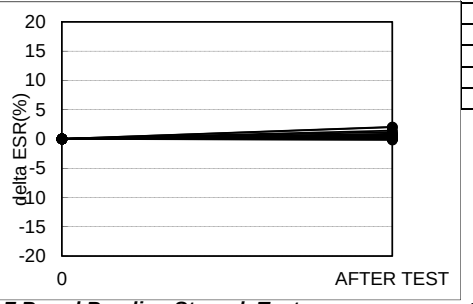
delta ESR(%)	
X-bar	0.18
3S	4.01
MAX	2.2
MIN	-2.0

6.Solder Iron Test



AFTER TEST

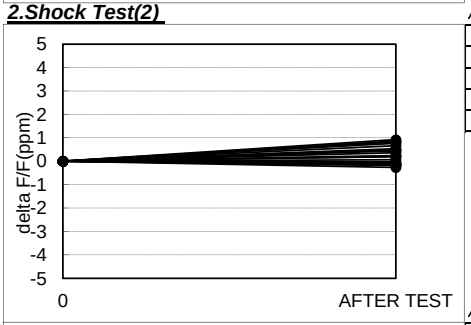
delta F/F(ppm)	
X-bar	-0.05
3S	0.49
MAX	0.2
MIN	-0.3



AFTER TEST

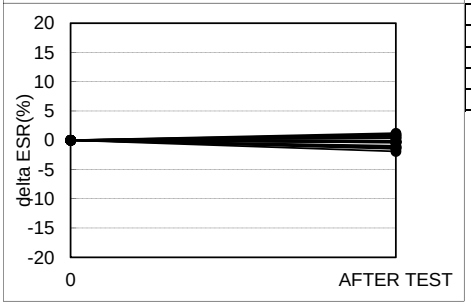
delta ESR(%)	
X-bar	0.59
3S	1.93
MAX	2.0
MIN	-0.2

2.Shock Test(2)



AFTER TEST

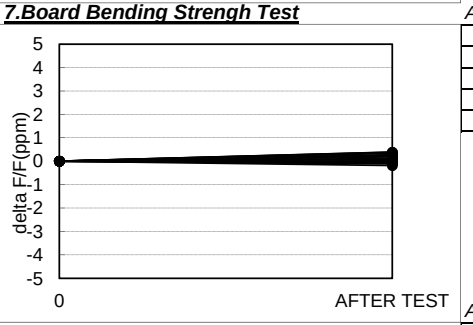
delta F/F(ppm)	
X-bar	0.27
3S	1.18
MAX	0.9
MIN	-0.3



AFTER TEST

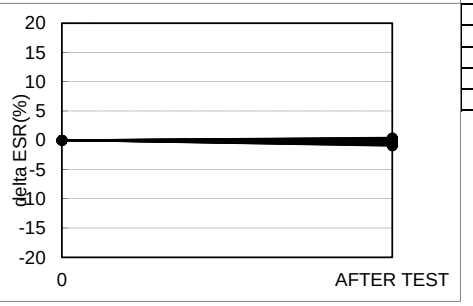
delta ESR(%)	
X-bar	-0.25
3S	2.67
MAX	1.2
MIN	-1.9

7.Board Bending Strengh Test



AFTER TEST

delta F/F(ppm)	
X-bar	0.14
3S	0.53
MAX	0.4
MIN	-0.2

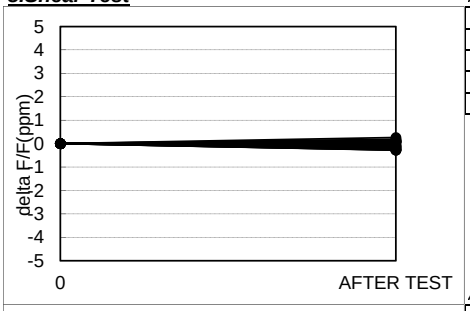


AFTER TEST

delta ESR(%)	
X-bar	-0.22
3S	1.40
MAX	0.4
MIN	-1.0

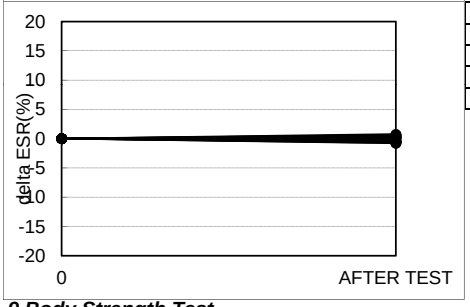
DSR221STH 19.200MHz (RoHS Compliant Part)
(HARMONY THAILAND)

8.Shear Test



AFTER TEST

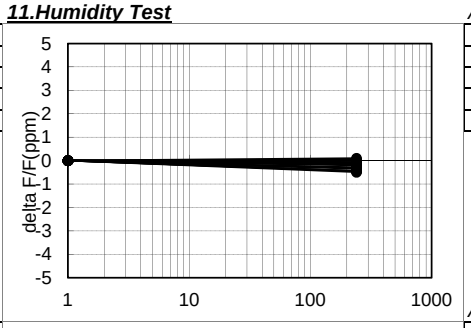
delta F/F(ppm)	
X-bar	-0.05
3S	0.53
MAX	0.3
MIN	-0.3



AFTER TEST

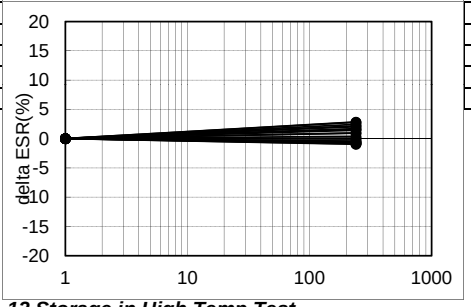
delta ESR(%)	
X-bar	-0.06
3S	1.51
MAX	0.8
MIN	-0.8

11.Humidity Test



AFTER 240hours

delta F/F(ppm)	
X-bar	-0.18
3S	0.56
MAX	0.1
MIN	-0.5



AFTER 240hours

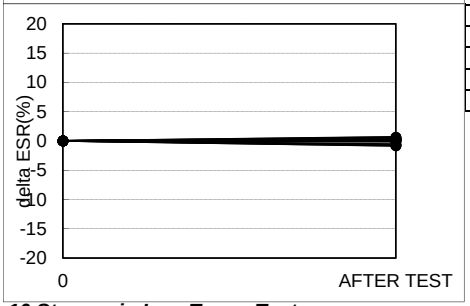
delta ESR(%)	
X-bar	0.70
3S	3.97
MAX	2.8
MIN	-1.0

9.Body Strength Test



AFTER TEST

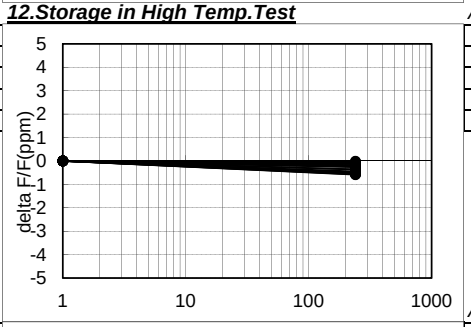
delta F/F(ppm)	
X-bar	0.07
3S	0.62
MAX	0.4
MIN	-0.3



AFTER TEST

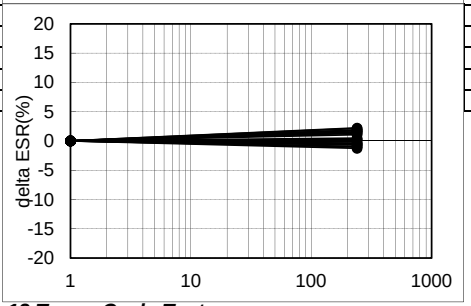
delta ESR(%)	
X-bar	0.01
3S	1.44
MAX	0.7
MIN	-0.8

12.Storage in High Temp.Test



AFTER 240hours

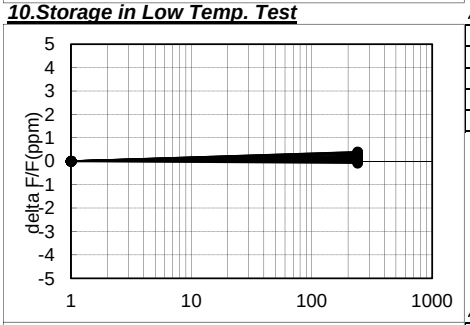
delta F/F(ppm)	
X-bar	-0.30
3S	0.61
MAX	0.0
MIN	-0.6



AFTER 240hours

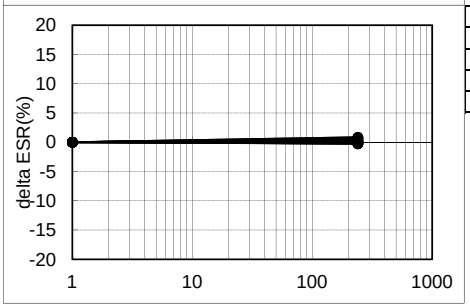
delta ESR(%)	
X-bar	0.52
3S	3.50
MAX	2.2
MIN	-1.3

10.Storage in Low Temp. Test



AFTER 240hours

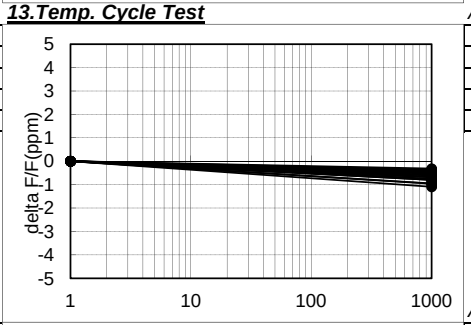
delta F/F(ppm)	
X-bar	0.18
3S	0.43
MAX	0.4
MIN	-0.1



AFTER 240hours

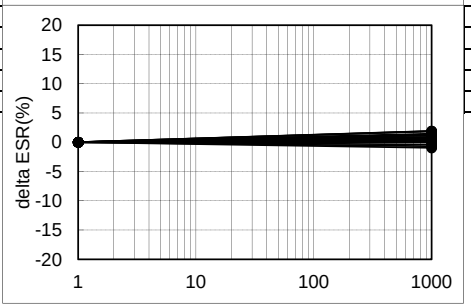
delta ESR(%)	
X-bar	0.21
3S	1.13
MAX	0.8
MIN	-0.3

13.Temp. Cycle Test



AFTER 1000cycles

delta F/F(ppm)	
X-bar	-0.65
3S	0.63
MAX	-0.3
MIN	-1.1



AFTER 1000cycles

delta ESR(%)	
X-bar	0.67
3S	2.47
MAX	1.9
MIN	-1.0

4 (2). SEALING TIGHTNESS TEST

SPEC : $2.0E^{-9}$ $Pa*m^3/sec$ MAX

RESULT

QMIN 9.9 E-11(Pa*m3/sec)

No.	RESULT($Pa*m^3/sec$)	
1	5.8	E-10
2	5.6	E-10
3	4.7	E-10
4	4.1	E-10
5	5.1	E-10
6	5.3	E-10
7	4.3	E-10
8	4.1	E-10
9	5.5	E-10
10	4.1	E-10
11	5.3	E-10
12	5.1	E-10
13	5.5	E-10
14	5.3	E-10
15	4.4	E-10
16	4.0	E-10
17	4.7	E-10
18	5.8	E-10
19	4.8	E-10
20	4.1	E-10