



广东惠伦晶体科技股份有限公司
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PRODUCT SPECIFICATION SHEET

CUSTOMER : _____
PRODUCT TYPE : SMD TSX 2.0*1.6(4PAD)
NOMINAL FREQ. : 19.200000 MHz
FL P/N : 9Z19200001
REVISION : SAMPLE
CUSTOMER P/N : _____

CUSTOMER'S APPROVAL&DATE

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FL CORPORATION

APPROVED	CHECKED	DESIGNED
Liu GuoQiang	Jin Qi	Weng QiuLin

RoHS Compliant



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ATTACHMENT (optional)

- | | | | |
|------------------------------------|---|------------------------------|--|
| • ELECTRICAL CHARACTERISTICS TEST | A | <input type="checkbox"/> YES | <input checked="" type="checkbox"/> NO |
| • TEMPERATURE CHARACTERISTICS TEST | B | <input type="checkbox"/> YES | <input checked="" type="checkbox"/> NO |



ELECTRICAL SPECIFICATIONS

Standard atmospheric conditions

Unless otherwise specified. The standard range of atmospheric conditions for making measurement and tests are as follow:

Ambient temperature $25\pm 10^{\circ}\text{C}$
Relative humidity $40\%\sim 70\%$

If there is any doubt about the results, measurement shall be made within the following limits:

Ambient temperature $25\pm 3^{\circ}\text{C}$
Relative humidity : $40\%\sim 70\%$

Measure equipment

Electrical characteristics measured by S&A250B or equivalent.

Crystal cutting type

The crystal is using AT CUT (thickness shear mode)

Weight

0.086g/piece (TYP) , $26\pm 1.3\text{g}/3\text{kpcs}$ (regardless of tape weight)

	Parameters	Symbol	Electrical Spec.				Condition	Notes
			Min.	Typ.	Max.	Units		
1	Nominal Frequency	FL	19.200000			MHz	-	-
2	Oscillation Mode	-	Fundamental			-	-	-
3	Load Capacitance	CL	7.0			pF	-	1
4	Frequency Tolerance	-	± 10			ppm	at $25\pm 3^{\circ}\text{C}$	-
5	Frequency Stability Over Operating Temp. Range(Reference 25°C)	-	± 12			ppm	$-30^{\circ}\text{C}\sim +85^{\circ}\text{C}$	2
6	Frequency drift after reflow	-	-	-	± 2	ppm	After two reflows	-
7	Operating Temperature	-	-30	~	105	$^{\circ}\text{C}$	-	-
8	Aging	-	-	-	± 0.7	ppm/yea	-	-
9	Drive Level	DL	10	-	100	μW	-	-
10	Equivalent Series Resistance	ESR	-	-	80	Ω	-	-
11	Shunt Capacitance C0	C0	0.3	~	1.3	pF	-	-
12	Motional Capacitance C1	C1	1.2	~	3.1	fF	-	-
13	Insulation Resistance	-	500	-	-	M Ω	at DC 100V	-
14	Storage Temperature Range	-	-40	~	105	$^{\circ}\text{C}$	-	-
15	Spurious Mode Series Resistance	-	1100	-	-	Ω	$\pm 1\text{MHz}$	-
16	Q Factor	Q	75000	-	-	-	-	3
17	First-order Curve Fitting Parameter	-	-0.4	-	-0.1	ppm/ $^{\circ}\text{C}$	-	4
18	Second-order Curve Fitting Parameter	-	-4.5	0	4.5	$\times 10^{-4}$ ppm/ $^{\circ}\text{C}^2$	-	4
19	Third-order Curve Fitting Parameter	-	8.5	10	11.5	$\times 10^{-5}$ ppm/ $^{\circ}\text{C}^3$	-	4
20	Residual Frequency stability slope	-	-	-	± 50	ppb/ $^{\circ}\text{C}$	-	5
21	5°C small orbit hysteresis 1	-	-	-	± 50	ppb/ $^{\circ}\text{C}$	-	6



	Parameters	Symbol	Electrical Spec.				Condition	Notes
			Min.	Typ.	Max.	Units		
22	5°C small orbit hysteresis 2	-	100			ppb pk-	-	7
23	Inflection Point	-	30.5	~	33.5	°C	$t=(t_0-\frac{C^2}{3C^3})$	-
24	DLD Freq (Max-Min)	-	-	-	3	ppm	-	8
25	DLD Freq (Repeatability)	-	-	-	0.7	ppm	-	8
26	DLD ESR (Max-Min)	-	-	-	20	%	-	8
27	DLD ESR (Repeatability)	-	-	-	10	%	-	8

Note 1 The load capacitance is measured according to IEC Standard #60444-7

Note 2 Above 85°C tolerance over temperature bound by third-order coefficient range

Note 3 Minimum Q value calculated from ESR and L is smaller than this specification

Note 4 The curve fitting parameter is obtained from the Qualcomm crystal curve fitting algorithm, $t_0=32\text{ }^\circ\text{C}$ (Refer to Curve Fitting Calculation Table: 80-V9690-23 Rev.C)

Note 5 Condition 1A – Test condition (continuous temperature rate change of $\sim 1.0\text{ }^\circ\text{C}/\text{min}$):

- Measure FT points every 1°C, heating up from -30 to +85°C, subtract a fifth-order polynomial best fit and then calculate the slope of the residual.
- The residual slope should be within $\pm 50\text{ ppb}/^\circ\text{C}$.

Note 6 Condition 1B – Hysteresis 1 test condition (continuous temperature rate change of $\sim 1.0\text{ }^\circ\text{C}/\text{min}$):

- Measure FT points every 0.5°C while cycling temperature over a 5°C small temperature orbit; an example 5° C small orbit temperature cycle is +30°C to +35°C to +30°C.
- During every individual heating/cooling cycle there should be 11 points; discard the first point of each heating and cooling cycle; this leaves 10 points for each heating and cooling cycle. Subtract the fifth-order polynomial best fit from 1A for each of the 10 points, and then calculate the slope of the residual for each of these heating and cooling 10 point curves.
- The residual slope should be within $\pm 50\text{ ppb}/^\circ\text{C}$.

Note 7 Condition 2 – Hysteresis 2 test condition (continuous temperature rate change of $\sim 1.0\text{ }^\circ\text{C}/\text{min}$):

- Measure FT points every 0.5°C while cycling temperature over a 5°C small temperature orbit; an example 5° C small orbit temperature cycle is +30°C to +35°C to +30°C.
- During every individual heating/cooling cycle there should be 11 points; discard the first and last point of each heating and cooling cycle, which results in 9 temperature points. Calculate the average measured peak-to-peak frequency difference for these 9 temperature points.
- The average difference is the magnitude of the small orbit hysteresis 2.

Note 8 0.01 uW to 100 uW to 0.01 uW, number of points: 15 points up and 15 points down = 29 total data points

Note 9 This crystal specification complies to Qualcomm Mini-Specification 80-V9690-26 Rev.D

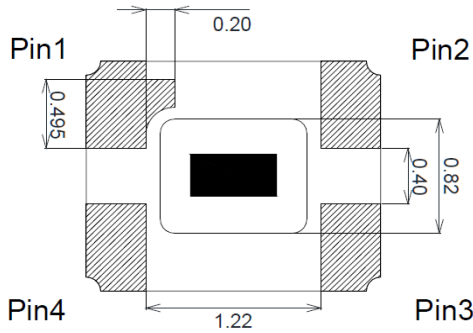
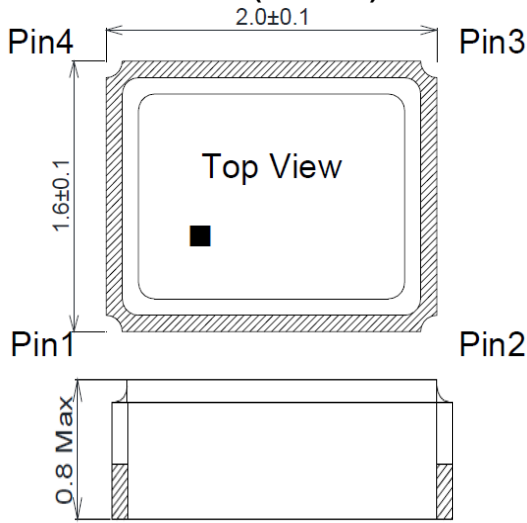
NTC THERMISTOR ELECTRICAL SPECIFICATIONS

	Parameters	Symbol	Electrical Spec.				Notes
			Min.	Typ.	Max.	Units	
1	Resistance (25 °C)	-	100k ± 1%			Ω	-
2	B-Constant (25-50 °C)	-	4250 ± 1%			K	1
3	Operating Temperature	-	-30	-	105	°C	-

Note 1 The B constant is calculated using the zero-power resistance values measured at 25°C and 50°C



■ DIMENSIONS (Unit:mm)

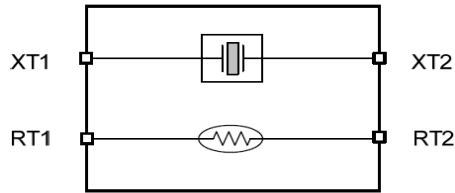


■ PIN FUNCTION

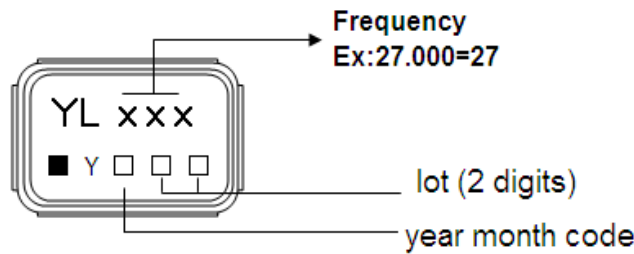
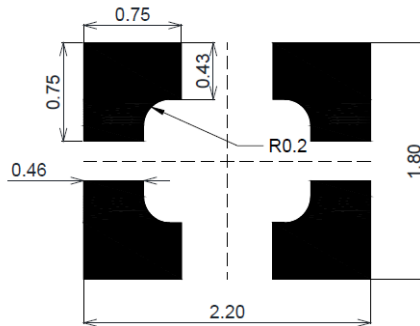
	Symbol	Function
Pin 1	XT1	XTAL Terminal 1
Pin 2	RT2	Thermistor Terminal 2
Pin 3	XT2	XTAL Terminal 2
Pin 4	RT1	Thermistor Terminal 1

Note: Pin 2 is connected to the metal lid and thermistor
 Pin 4 is connected to the thermistor only

■ BLOCK DIAGRAM

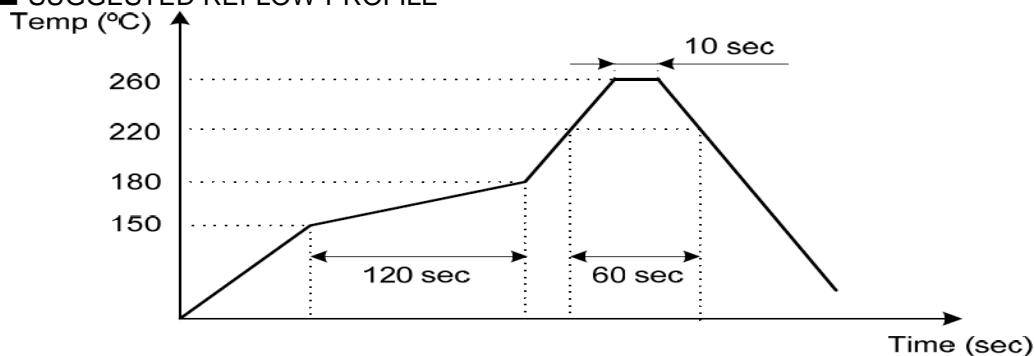


■ SUGGESTED LAYOUT



		month											
year		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2009	2013	A	B	C	D	E	F	G	H	J	K	L	M
2010	2014	N	P	Q	R	S	T	U	V	W	X	Y	Z
2011	2015	a	b	c	d	e	f	g	h	j	k	l	m
2012	2016	n	p	q	r	s	t	u	v	w	x	y	z

■ SUGGESTED REFLOW PROFILE

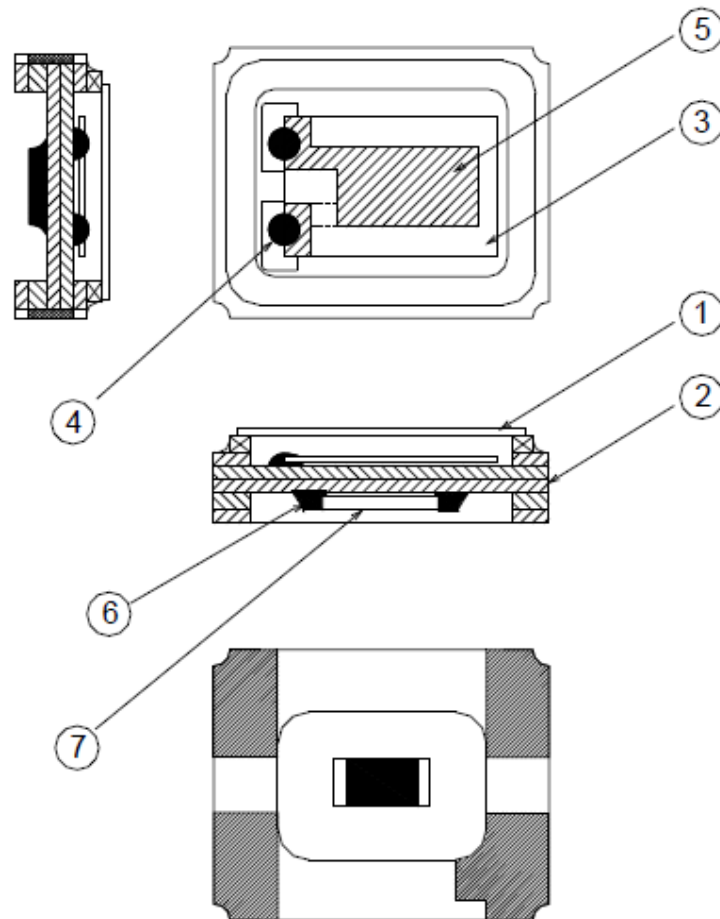


Note : Total Time: 200 sec. Max., Solder Melting Point: 220°C



■ STRUCTURE ILLUSTRATION

Crystal Enclosure Seal : Seam Welding



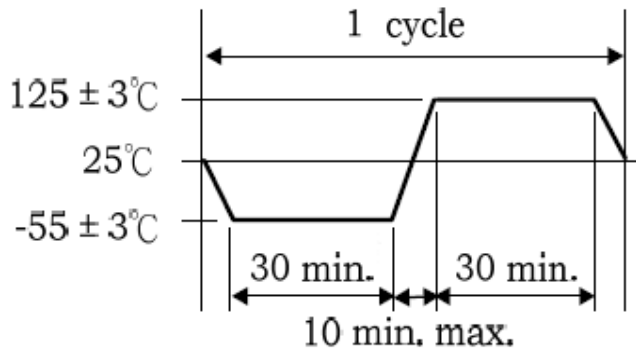
NO	COMPONENTS	MATERIALS	FINISH/SPECIFICATIONS
1	Lid	Metal (Fe+Co+Ni)	-
2	Base(Package)	Ceramic (Al ₂ O ₃) + Kovar (Fe+Co+Ni)+Ag/C	Alumina ceramics
3	Crystal blank	SiO ₂	-
4	Conductive adhesive	Ag	Silicone resin
5	Electrode	Noble Metal	-
6	Solder	Sn	-
7	Thermistor	Al ₂ O ₃ , Ag, Ni	-

RELIABILITY SPECIFICATIONS

1.MECHANICAL ENDURANCE

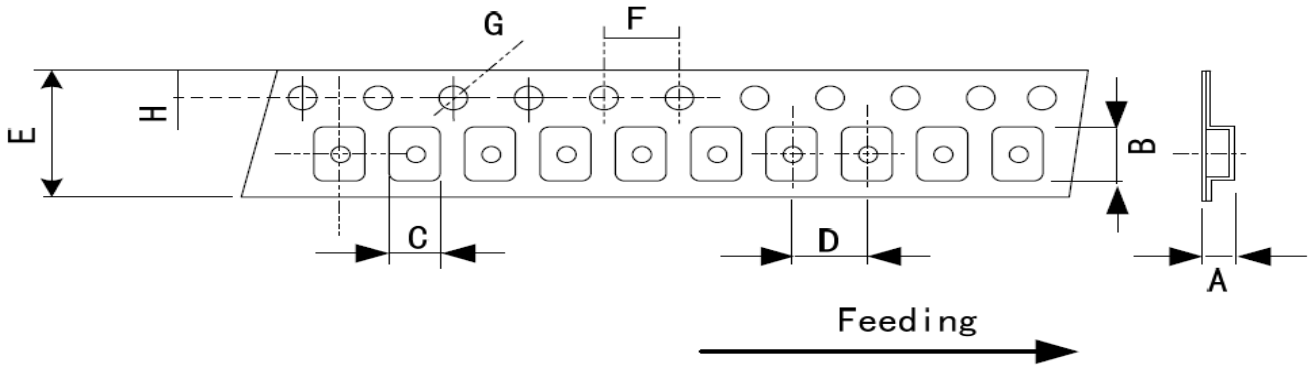
No.	Test Item	Methods	REF.DOC
1.1	Drop Test	150 cm height, 3 times on concrete floor.	JIS C6701
1.2	Mechanical Shock MIL-STD	Device are shocked to half sine wave (1000 G) three mutually perpendicular axes each 3 times. 0.5m sec. duration time	MIL-STD-202
1.3	Vibration	Frequency range 10 ~ 2000 Hz Amplitude 1.52 mm/20G Sweep time 20 minutes perpendicular axes each test time 4 Hrs (Total test time 12 Hrs)	MIL-STD-883
1.4	Gross Leak	Standard Sample For Automatic Gross Leak Detector, Test Pressure: 2kg / cm ²	MIL-STD-883
1.5	Fine Leak	Helium Bombing 4.5 kg/ cm ² for 2 Hrs	
1.6	Solder ability	Temperature 245 °C ± 5°C Immersing depth 0.5 mm minimum Immersion time 5 ± 1 seconds Flux Rosin resin methyl alcohol solvent (1 : 4)	MIL-STD-883

2.Environmental Endurance

No.	Test Item	Methods	REF.DOC
2.1	Resistance To Soldering He	Pre-heat temperature 125 °C Pre-heat time 60 ~ 120 sec. Test temperature 260 ± 5 °C Test time 10 ± 1 sec.	MIL-STD-202
2.2	High Temp. Storage	+ 125 °C ± 3 °C for 500 ± 12 Hrs	MIL-STD-883
2.3	Low Temp. Storage	- 40 °C ± 3 °C for 500 ± 12 Hrs	
2.4		Total 100 cycles of the following temperature cycle 	MIL-STD-883
2.5	High Temp& Humidity	85°C ± 3°C, RH 85% , 500 Hrs	EIA-JESD22

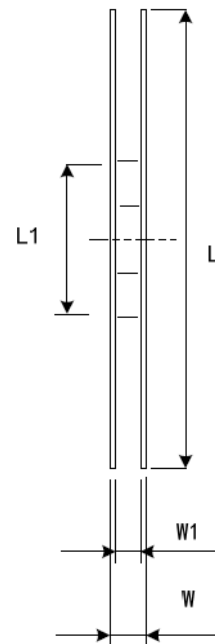
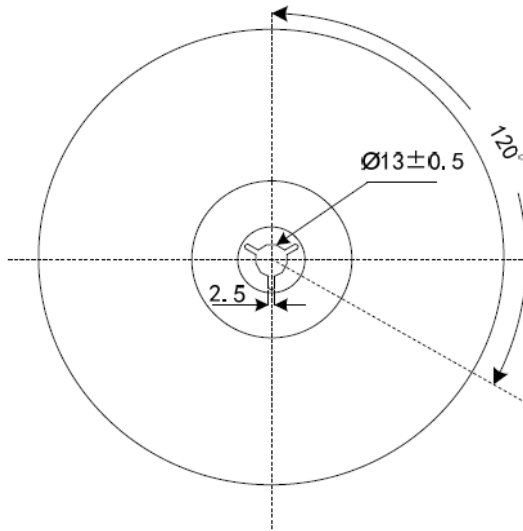
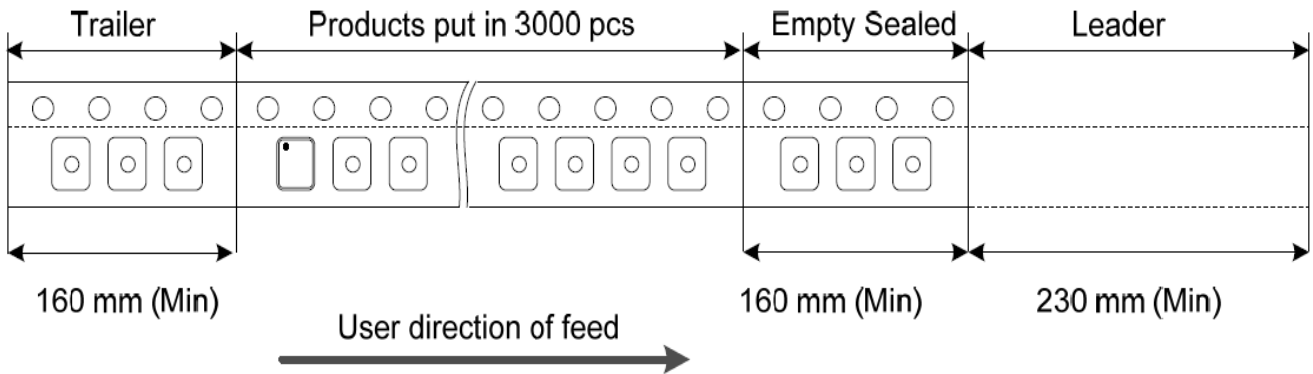


■ PACKING



DIMENSIONS	A	B	C	D	E	F	G	H	(UNIT:mm)
	0.90 ±0.10	2.30 ±0.10	1.90 ±0.10	4.00 ±0.10	8.00 ±0.20	4.00 ±0.10	1.55 ±0.05	1.75 ±0.10	

REMARK :


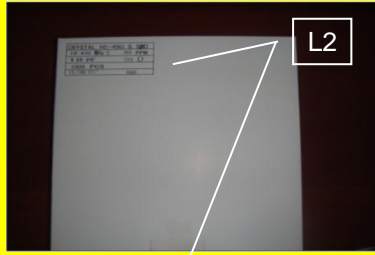


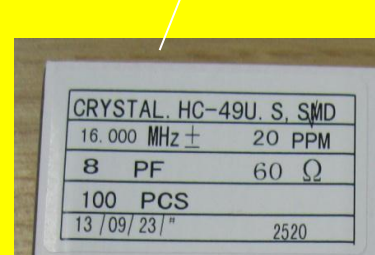



DIMENSIONS	L	L1	W	W1	Standard Reel Quantity is 3,000 pcs per reel(UNIT:mm)
	178.00 ±1.00	60.20 ±0.50	11.50 ±0.2	8.00 +1/-0	


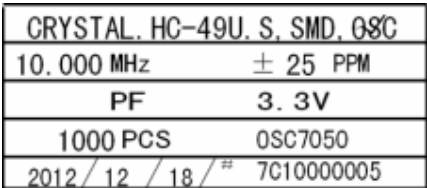
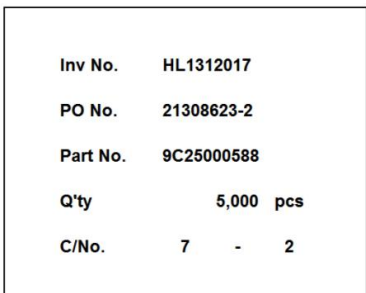


SMD PRODUCT PACKING STANDARD

Out-going packing instruction

Reel Packing	Inner Packing	Carton
name: reel standard: diameter 18cm material: plastics	name: inner box standard: L19.0xW19.0xH2.5cm material: B corrugated paper	name: carton standard: L34.0xW22.0xH22.0cm material: AB corrugated paper(10 boxes enter)
		
		

The label instruction

Label Drawing	Mark	Name of Article	Spec.	Size	Printing
	L1	条码标签 Bar Code Label (Chintz Paper)	1.Date Code 2.Lot No. 3.Part No. 4.Freq 5.Q'ty	75x35mm	White
	L2	机打标签 Printing Label (Printing Paper)	1.Freq 2.Electrical Parameters 3.Q'ty 4.Part No. 5.Packing Date	75x35mm	White
	L3	运输标签(唛头) Shipping Mark (Printing Paper)	1.inv No. 2.PO No. 3.Part No. 4.Q'ty 5.C/No.	100x100mm	White

Remark

Specifications on the label is for the use of templates with different product specifications may vary.
 If customer specified requirements for labels packaging, please provide the operation procedure.



Range	Products	Packing Material	Test Method
Banned Substances	Maximum concentration ppm(mg/kg)	Maximum concentration ppm(mg/kg)	
1.镉及镉化合物 Cadmium and cadmium compounds	5	5	ICP-AES as per EN1122, method B2001 or other acid digestion.
2.铅及铅化合物 Lead and lead compounds	40	100	ICP-AES after as per EPA 3050B or other acid digestion.
3.汞及汞化合物 Mercury and mercury compounds	5	5	ICP-AES after as per EPA 3052 or other acid digestion.
4.六价铬化合物 Hexavalent-Chromium VI (Cr+6)	10	10	As per US EPA 7196A and US EPA 3060A.
5.聚溴联苯 PBB Polybrominated biphenyls	5	5	With reference to USEPA 3540 or USEPA3550. Analysis was performed by LPLC/DAD, LC/MS or GC/MS. (prohibited by 2002/95/EC (RoHS),83/261/EEC, and76/769/EEC)
6.聚溴二苯醚 PBDE Polybrominated diphenyl ethers	5	5	With reference to USEPA3540or USEPA3550. Analysis was performed by HPLC/DAD LC/MS or GC/MS.(prohibited by 2002/95/EC(RoHS), 83/264/EEC, and 76/769/EEC)
7.多氯联苯 (PCB) Polychlorinated biphenyl	5	5	
8.多氯化萘 (PCN) Polychlorinated naphthalene	5	5	
9.氯代烷烃 (CP) Chlorinated paraffin	5	5	
10.其他有机氯化物 Other chlorinated organic compounds	5	5	
11.其他有机溴化合物 Other brominated organic compounds	5	5	
12.有机锡化合物 (三丁基锡化合物,三苯基锡化合物) Organic tin compounds (Tributyl tin category & Triphenyl tin category)	5	5	
13.石棉 Asbestos	5	5	
14.偶氮化合物 Azo compounds	5	5	
15.甲醛 Formaldehyde	5	5	
16.聚氯乙烯(PVC)以及聚氯乙烯混合物 Polyvinyl chloride (PVC) and PVC blends	No detect	No detect	
17.包装材料中重金属(汞、镉、六价铬、铅、PBB、PBDE)之总量 Heavy metals (mercury, cadmium, lead, Cr+6,PBB and PBDE) in packing	N/A	<100	

Lead Free Products are "Directive 2002/95/EC of The European Parliament of 27 January 2003 on the restriction of certain hazardous substances (RoHS) in electrical and electronic equipment" and Sony SS-00259 Compliant.



惠伦晶体

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