

# **ICP Test Report Certification Packet**

Littelfuse, Inc.		
Ceramic Chip Fuse	0603	
438 Series (2-6 Amp	o - Silver)	
September 25, 2013		
stricted substance nor stricted substance nor strength terials, and for additive ported to you that the properties of packaging materials, and	such use, for materials to be used for unit parts is and the like in the manufacturing processes. Parts and sub-materials, the materials to be use and the additives and the like in the manufacturing	s, d
Issued by: -	JORDANUFF H. CABILAN <global ehs="" engineer=""></global>	
vers the Ceramic Chip	o Fuse 0603 RoHS-Compliant series product	S
	Ceramic Chip Fuse (438 Series (2-6 Amp September 25, 2013) Littelfuse, Inc. that therefricted substance nor sterials, and for additive ported to you that the processor of the following corresponds of the following corresponds to the following corresponds of the following corresponds to the following corre	Ceramic Chip Fuse 0603  438 Series (2-6 Amp - Silver)  September 25, 2013  Littelfuse, Inc. that there is neither RoHS (2011/65/EU – recast of Elestricted substance nor such use, for materials to be used for unit parts sterials, and for additives and the like in the manufacturing processes. ported to you that the parts and sub-materials, the materials to be used packaging materials, and the additives and the like in the manufacturing sed of the following components.  Issued by:  JORDANUFF H. CABILAN



Table 1: List of Raw Materials covered by this report

Total Parts	Parts Raw Material Part Number Raw Material Description		Page(s)
1	039642	Body – Ceramic Substrate	3-9
2	011002	Element/Leads – Conductor Paste	10-19
3	011003	Cover Glass – Overglaze Paste	20-29
4	011004	Underglaze – Dielectric Paste	30-39
5	011001	Termination – Silver End Paste	40-49
6	010118	Plating – Nickel Anode	50-55
7	010119	Plating – Tin Anode	56-61



Number: TWNC00286467 Test Report

Littelfuse Philippines Inc. Applicant: Date : Nov 22, 2012

LIMA Technology Center, Lipa City,

Malvar, Batangas

Sample Description:

One (1) group of submitted samples said to be : Part Description : Ceramic Substrate

: 039642 Part Number

Date Sample Received : Nov 15, 2012 Date Test Started : Nov 17, 2012

Test Conducted :

As requested by the applicant, for details please refer to attached pages.

Authorized By: On Behalf Of Intertek Testing Services Taiwan Limited



K. Y. Liang Director





Test Conducted

# (I) Test Result Summary:

Test Result Summary:	
Test Item	Result (ppm)
TESC ICEIL	White Ceramic
Heavy Metal	
Cadmium (Cd) content	ND
Lead (Pb) content	ND
Mercury (Hg) content	ND
Chromium VI (Cr <sup>6+</sup> ) content	ND
Polybrominated Biphenyls (PBBs)	
Monobrominated Biphenyls (MonoBB)	ND
Dibrominated Biphenyls (DiBB)	ND
Tribrominated Biphenyls (TriBB)	ND
Tetrabrominated Biphenyls (TetraBB)	ND
Pentabrominated Biphenyls (PentaBB)	ND
Hexabrominated Biphenyls (HexaBB)	ND
Heptabrominated Biphenyls (HeptaBB)	ND
Octabrominated Biphenyls (OctaBB)	ND
Nonabrominated Biphenyls (NonaBB)	ND
Decabrominated Biphenyl (DecaBB)	ND
Polybrominated Diphenyl Ethers (PBDEs)	
Monobrominated Diphenyl Ethers (MonoBDE)	ND
Dibrominated Diphenyl Ethers (DiBDE)	ND
Tribrominated Diphenyl Ethers (TriBDE)	ND
Tetrabrominated Diphenyl Ethers (TetraBDE)	ND
Pentabrominated Diphenyl Ethers (PentaBDE)	ND
Hexabrominated Diphenyl Ethers (HexaBDE)	ND
Heptabrominated Diphenyl Ethers (HeptaBDE)	ND
Octabrominated Diphenyl Ethers (OctaBDE)	ND
Nonabrominated Diphenyl Ethers (NonaBDE)	ND
Decabrominated Diphenyl Ether (DecaBDE)	ND
Halogen Content	
Fluorine (F)	ND
Chlorine (Cl)	ND
Bromine (Br)	ND
Iodine (I)	ND

Remarks: ppm = Parts per million based on weight of tested sample = mg/kg

ND = Not detected

Responsibility of Chemist : Irene Chiou / Kevin Liu / Cathy Chen

Date Sample Received : Nov 15, 2012

Test Period : Nov 17, 2012 To Nov 21, 2012





## Test Conducted

## ( $\Pi$ ) RoHS Limits:

Restricted Substances	<u>Limits</u>
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)
Polybrominated Biphenyls (PBBs)	0.1% (1000ppm)
Polybrominated Diphenyl Ehters (PBDEs)	0.1% (1000ppm)

The above limits were quoted from Annex II of 2011/65/EU for homogeneous material.

# $( \hspace{.05cm} \coprod \hspace{.05cm} )$ Test Method:

Test Item	Test Method	Reporting Limit
Cadmium (Cd) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321 edition 1.0:2008 in clause 7, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex C, by alkaline digestion and determined by UV-Vis spectrophotometer.	1 ppm





Test Conducted

## (Ⅲ) Test Method:

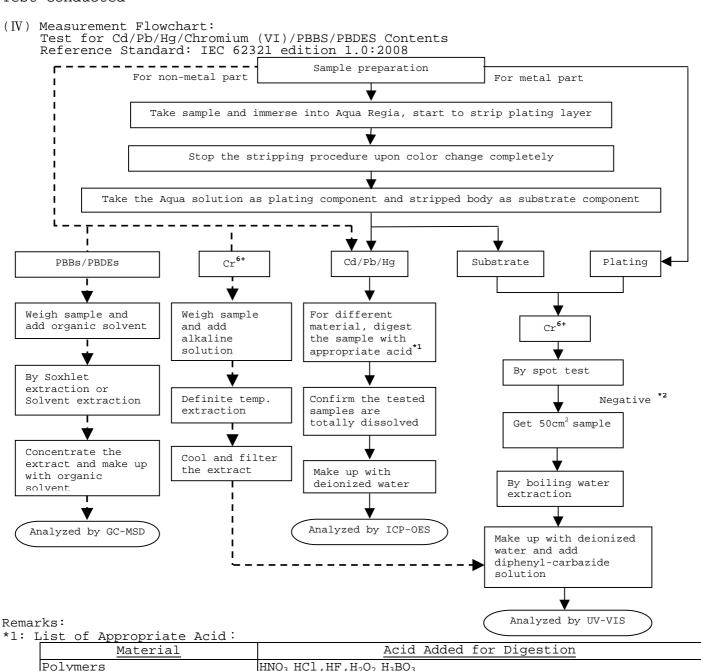
Test Item	Test Method	Reporting Limit
Polybrominated Biphenyls (PBBs)	With reference to IEC 62321 edition 1.0:2008 in annex A, by solvent extraction and determined by GC-MS and further HPLC-DAD confirmation when necessary.	5 ppm
Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 edition 1.0:2008 in annex A, by solvent extraction and determined by GC-MS and further HPLC-DAD confirmation when necessary.	5 ppm
Halogen Content	With reference to EN 14582:2007 by calorimetric bomb with oxygen and determined by Ion Chromatograph.	50 ppm

Remark: Reporting limit = Quantitation limit of analyte in sample





## Test Conducted



 Material
 Acid Added for Digestion

 Polymers
 HNO3, HCl, HF, H2O2, H3BO3

 Metals
 HNO3, HCl, HF

 Electronics
 HNO3, HCl, H2O2, HBF4

\*2: If the result of spot test is positive, Chromium VI would be determined as detected.



# Intertek Testing Services Taiwan Ltd.

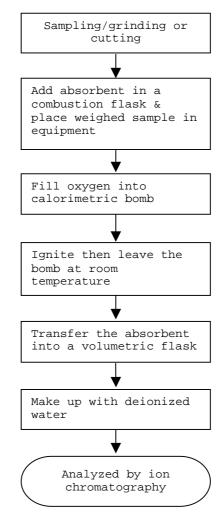
8F., No. 423, Ruiguang Rd., Neihu District, Taipei 114, Taiwan, R.O.C. 全國公證檢驗股份有限公司



Test Conducted

#### (IV) Measurement Flowchart:

Test for Halogen Content Reference Standard: EN 14582



End of Report

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Test Conducted

Number: TWNC00286467

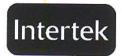
#### Photo







# Intertek Testing Services Taiwan Ltd.



Number : TWNC00324412

: Jul 25, 2013

Date

Applicant: Littelfuse Philippines Inc.

LIMA Technology Center, Lipa City,

Malvar, Batangas

Sample Description:

One (1) group of submitted samples said to be:

Part Description : Sintered Conductor Paste(Silver)

Part Number : 011002 Date Sample Received : Jul 22, 2013 Date Test Started : Jul 23, 2013

Test Conducted:

As requested by the applicant, for details please refer to attached pages.

Authorized by:

On Behalf of Intertek Testing Services

Taiwan Limited

K. Y. Liang Director

Page 1 of 12



Number:

TWNC00324412

Test Conducted Test Result Summary:

Test I	tem	Unit	Test Method	Result	RL
TCSCI	cem	Offic	<u>rest Metriod</u>	White/silvery material	- KL
Heavy Metal		4			
Cadmium (Cd)	content	ppm	With reference to IEC 62321: 2008, by microwave digestion and determined by ICP-OES.	ND	2
Lead (Pb) conte	ent	ppm	With reference to IEC 62321: 2008, by microwave digestion and determined by ICP-OES.	ND	2
Mercury (Hg) c	ontent	ppm	With reference to IEC 62321: 2008, by microwave digestion and determined by ICP-OES.	ND	2
Antimony (Sb)	Content	ppm	With reference to USEPA 3052, by microwave digestion and determined by ICP-OES.	ND	2
Chromium VI ((	Cr <sup>6+</sup> ) content	ppm	With reference to IEC 62321: 2008, by alkaline digestion and determined by UV-Vis Spectrophotometer.	ND	1
<b>Polybrominat</b>	ed Biphenyls	(PBBs)			
Mono <mark>b</mark> rominate (MonoBB)	ed Biphenyls	ppm		ND	5
Dibro <mark>m</mark> inated B (DiBB)	siphenyls	ppm		ND	5
Tribro <mark>minated {</mark> (TriBB)	Biphenyls	ppm		ND	5
Tetra <mark>b</mark> rominate (TetraBB)	d Biphenyls	ppm		ND	5
Pentabrominate (PentaBB)	ed Biphenyls	ppm	With reference to IEC 62321: 2008, by solvent extraction	ND	5
Hexabrominate (HexaBB)	d Biphenyls	ppm	and determined by GC-MS and further HPLC-DAD confirmation	ND	5
Heptabrominate (HeptaBB)	ed Biphenyls	ppm	when necessary.	ND	5
Octab <mark>r</mark> ominated (OctaBB)	d Biphenyls	ppm		ND	5
Nonabrominate (NonaBB)	d Biphenyls	ppm		ND	5
Decabrominate (DecaBB)	d Biphenyl	ppm		ND	5

Page 2 of 12



Test Conducted

Number: TWNC00324412

Test Item	<u>Unit</u>	Test Method	Result White/silvery material	RL
Polybrominated Dipheny	Ethers (	(PBDEs)		-1
Monobrominated Diphenyl Ethers (MonoBDE)	ppm		ND	5
Dibrominated Diphenyl Ethers (DiBDE)	ppm		ND	5
Tribrominated Diphenyl Ethers (TriBDE)	ppm		ND	5
Tetrabrominated Diphenyl Ethers (TetraBDE)	ppm	M644	ND	5
Pentabrominated Diphenyl Ethers (PentaBDE)	ppm	With reference to IEC 62321: 2008, by solvent extraction	ND	5
Hexabrominated Diphenyl Ethers (HexaBDE)	ppm	and determined by GC-MS and further HPLC-DAD confirmation when necessary.	ND	5
Heptabrominated Diphenyl Ethers (HeptaBDE)	ppm	when necessary.	ND	5
Octabrominated Diphenyl Ethers (OctaBDE)	ppm		ND	5
Nonabrominated Diphenyl Ethers (NonaBDE)	ppm		ND	5
Decabrominated Diphenyl Ether (DecaBDE)	ppm		ND	5
Halogen Content	-			',''
Fluorine (F)	ppm	With reference to EN	ND	50
Chlori <mark>ne (Cl)</mark>	ppm	14582:2007 by calorimetric	ND	50
Bromi <mark>ne (Br)</mark>	ppm	bomb with oxygen and determined by Ion	ND	50
Iodine (I)	ppm	Chromatograph.	ND	50
Phthalates	***********		Special mode	-
Di(2-ethylhexyl) Phthalate (DEHP)	ppm		ND	10
Dibutyl Phthalate (DBP)	ppm	With reference to EN 14372:	ND	10
Benzyl Butyl Phthalate (BBP)	ppm	2004, by solvent extraction and determined by GC-MS.	ND	10
Diisobutyl Phthalate (DIBP)	ppm		ND	10



Number:

TWNC00324412

#### Test Conducted

Test Item	<u>Unit</u>	Test Method	<u>Result</u>	RL
- COC YCOM	Offic	<u>rest Metriou</u>	White/silvery material	
Others				
Hexabromocyclododecane (HBCDD)	ppm	With reference to USEPA 3540C, by solvent extraction and determined by GC-MS.	ND	10

Remarks: ppm = parts per million based on weight of tested sample = mg/kg

> ND = Not detected

RL = Reporting Limit, Quantitation limit of analyte in sample

Responsibility of Chemist: Kevin Liu/ Irene Chiou/ Vico Lin

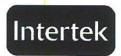
Date Sample Received : Jul 22, 2013

Test Period : Jul 23, 2013 To Jul 25, 2013

#### RoHS Limit

Restricted Substances	<u>Limits</u>
Cadmium (Cd) content	0.01% (100ppm)
Lead (Pb) content	0.1% (1000ppm)
Mercury (Hg) content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) content	0.1% (1000ppm)
Polybrominated Biphenyls (PBBs)	0.1% (1000ppm)
Polybrominated Diphenyl Ethers (PBDEs)	0.1% (1000ppm)

The above limits were quoted from Annex II of 2011/65/EU for homogeneous material.



Number: TWNC00324412

Test Conducted Measurement Flowchart:

Test for Cd/Pb/Hg/Chromium (VI)/PBBs/PBDEs Contents Reference Method: IEC 62321 edition 1.0:2008

Sample preparation For non-metal part For metal part Take sample and immerse into Aqua Regia, start to strip plating layer Stop the stripping procedure upon color change completely Take the Aqua solution as plating component and stripped body as substrate component Cr6+ PBBs/PBDEs Cd/Pb/Hg Substrate Plating Weigh sample and add Weigh sample and For different material, organic solvent digest the sample with add alkaline solution Cr6+ appropriate acid\*1 By spot test By Soxhlet extraction or Solvent extraction Definite temp. Confirm the tested Negative \*2 extraction samples are totally dissolved Get 50cm<sup>2</sup> sample Concentrate the extract Cool and filter the and make up with organic extract Make up with deionized solvent By boiling water water extraction Analyzed by ICP-OES Analyzed by GC-MS Make up with deionized water and add diphenyl-carbazide solution Remarks: \*1: List of Appropriate Acid: Analyzed by UV-VIS Material Acid Added for Digestion Polymers HNO<sub>3</sub>,HCl,HF,H<sub>2</sub>O<sub>2</sub>,H<sub>3</sub>BO<sub>3</sub> Metals HNO3, HCI, HF Electronics HNO3, HCI, H2O2, HBF4

\*2: If the result of spot test is positive, Chromium VI would be determined as detected.



Intertek Testing Services Taiwan Ltd.

8F., No. 423, Ruiguang Rd., Neihu District, Taipei 11492, Taiwan, R.O.C. 全國公證檢驗股份有限公司



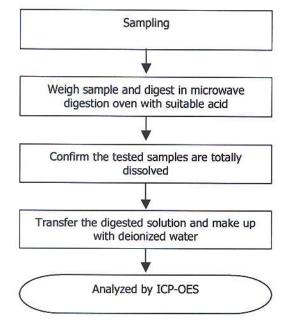
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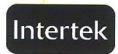
TWNC00324412

Test Conducted

Measurement Flowchart:

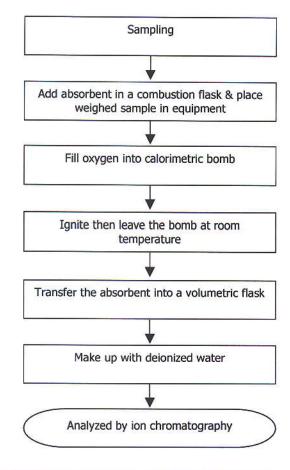
Test for Heavy Metal (Sb) Contents Reference Method: USEPA 3052

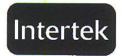




Test Conducted

Test for Halogen Contents Reference Method: EN 14582 Number: TWNC00324412





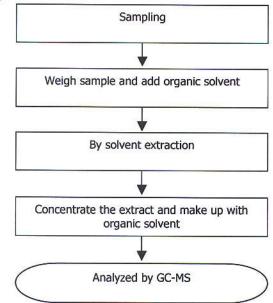
Number:

TWNC00324412

Test Conducted

Test for Phthalates Contents

Reference Method: EN 14372: 2004

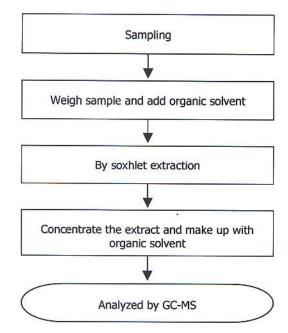


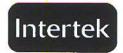


Number: TWNC00324412

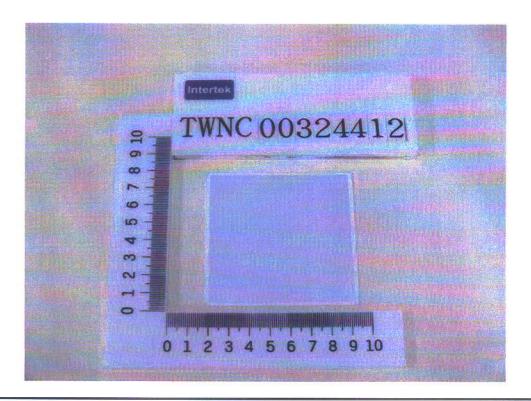
Test Conducted

Test for Hexabromocyclododecane (HBCDD) Content Reference Method: USEPA 3540C





Number: TWNC00324412



End of Report

This report is made solely on the basis of your instructions and/or information and materials supplied by you. It is not intended to be a recommendation for anyparticular course of action. Intertek does not accept a duty of care or any other responsibility to any person other than the Client in respect of this report and onlyaccepts liability to the Client insofar as is expressly contained in the terms and conditions governing Intertek's provision of services to you. Intertek makes nowarranties or representations either express or implied with respect to this report save as provided for in those terms and conditions. We have aimed to conductthe Review on a diligent and careful basis and we do not accept any liability to you for any loss arising out of or in connection with this report, in contract, tort, by statute or otherwise, except in the event of our gross negligence or wilful misconduct.



Number: TWNC00286468 Test Report

Littelfuse Philippines Inc. Applicant: Date : Nov 22, 2012

LIMA Technology Center, Lipa City,

Malvar, Batangas

Sample Description:

One (1) group of submitted samples said to be :

Part Description : Overglaze (Coverglass) Paste (Sintered)

: 011003 Part Number

Date Sample Received : Nov 15, 2012 Date Test Started : Nov 17, 2012

Test Conducted :

As requested by the applicant, for details please refer to attached pages.

Authorized By: On Behalf Of Intertek Testing Services Taiwan Limited



K. Y. Liang Director





Test Conducted

# ( I ) Test Result Summary :

, lest result building .	Result (ppm)
Test Item	Submitted Samples
Heavy Metal	
Cadmium (Cd) content	ND
Lead (Pb) content	ND
Mercury (Hg) content	ND
Chromium VI (Cr <sup>6+</sup> ) content	ND
Polybrominated Biphenyls (PBBs)	
Monobrominated Biphenyls (MonoBB)	ND
Dibrominated Biphenyls (DiBB)	ND
Tribrominated Biphenyls (TriBB)	ND
Tetrabrominated Biphenyls (TetraBB)	ND
Pentabrominated Biphenyls (PentaBB)	ND
Hexabrominated Biphenyls (HexaBB)	ND
Heptabrominated Biphenyls (HeptaBB)	ND
Octabrominated Biphenyls (OctaBB)	ND
Nonabrominated Biphenyls (NonaBB)	ND
Decabrominated Biphenyl (DecaBB)	ND
Polybrominated Diphenyl Ethers (PBDEs)	
Monobrominated Diphenyl Ethers (MonoBDE)	ND
Dibrominated Diphenyl Ethers (DiBDE)	ND
Tribrominated Diphenyl Ethers (TriBDE)	ND
Tetrabrominated Diphenyl Ethers (TetraBDE)	ND
Pentabrominated Diphenyl Ethers (PentaBDE)	ND
Hexabrominated Diphenyl Ethers (HexaBDE)	ND
Heptabrominated Diphenyl Ethers (HeptaBDE)	ND
Octabrominated Diphenyl Ethers (OctaBDE)	ND
Nonabrominated Diphenyl Ethers (NonaBDE)	ND
Decabrominated Diphenyl Ether (DecaBDE)	ND
Halogen Content	
Fluorine (F)	ND
Chlorine (Cl)	ND
Bromine (Br)	ND
Iodine (I)	ND





# Test Conducted

# ( I ) Test Result Summary :

Most Thom	Result (ppm)
Test Item	Submitted Samples
Phthalates	
Di(2-ethylhexyl) Phthalate (DEHP)	ND
Dibutyl Phthalate (DBP)	ND
Benzyl Butyl Phthalate (BBP)	ND
Others	
Hexabromocyclododecane (HBCDD)	ND

Remarks: ppm = Parts per million based on weight of tested sample = mg/kg

ND = Not detected

Responsibility of Chemist : Irene Chiou / Kevin Liu / Cathy Chen

Date Sample Received : Nov 15, 2012

Test Period : Nov 17, 2012 To Nov 21, 2012

## ( $\Pi$ ) RoHS Limits:

Restricted Substances	<u>Limits</u>
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)
Polybrominated Biphenyls (PBBs)	0.1% (1000ppm)
Polybrominated Diphenyl Ehters (PBDEs)	0.1% (1000ppm)

The above limits were quoted from Annex II of 2011/65/EU for homogeneous material.





## Test Conducted

## (Ⅲ) Test Method:

Test Item	Test Method	Reporting Limit
Cadmium (Cd) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321 edition 1.0:2008 in clause 7, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex C, by alkaline digestion and determined by UV-Vis spectrophotometer.	1 ppm
Polybrominated Biphenyls (PBBs)	With reference to IEC 62321 edition 1.0:2008 in annex A, by solvent extraction and determined by GC-MS and further HPLC-DAD confirmation when necessary.	5 ppm
Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 edition 1.0:2008 in annex A, by solvent extraction and determined by GC-MS and further HPLC-DAD confirmation when necessary.	5 ppm





## Test Conducted

## (Ⅲ) Test Method:

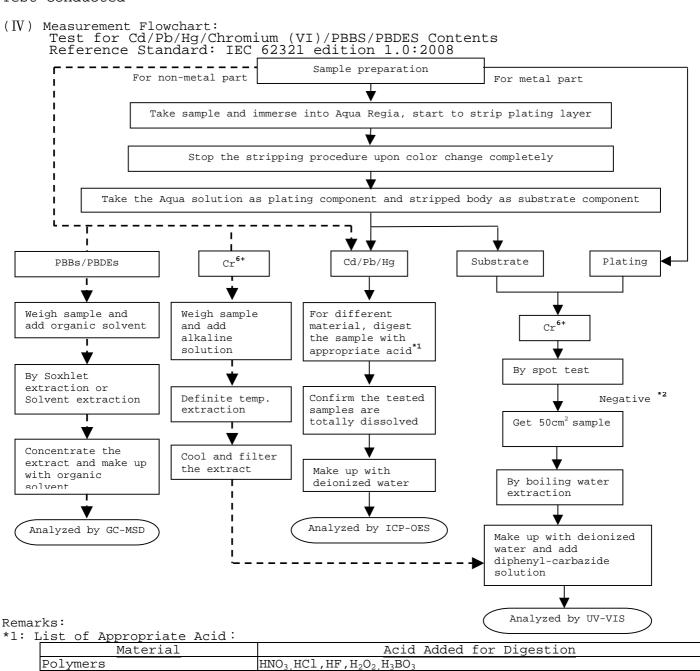
Test Item	Test Method	Reporting Limit
Halogen Content	With reference to EN 14582:2007 by calorimetric bomb with oxygen and determined by Ion Chromatograph.	50 ppm
Phthalates	With reference to EN 14372: 2004, by solvent extraction and determined by GC-MS.	50 ppm
Hexabromocyclododecane (HBCDD)	With reference to USEPA 3540C, by solvent extraction and determined by GC-MS.	10 ppm

Remark: Reporting limit = Quantitation limit of analyte in sample





## Test Conducted



MetalsHNO3,HCl,HFElectronicsHNO3,HCl,H2O2,HBF4

\*2: If the result of spot test is positive, Chromium VI would be determined as detected.



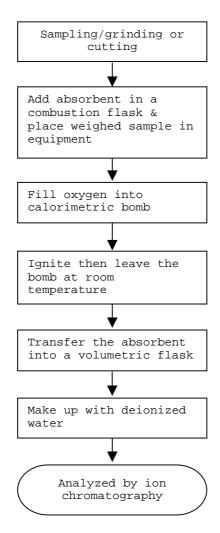
# Intertek Testing Services Taiwan Ltd.



Test Conducted

## ( ${ m IV}$ ) Measurement Flowchart:

Test for Halogen Content Reference Standard: EN 14582



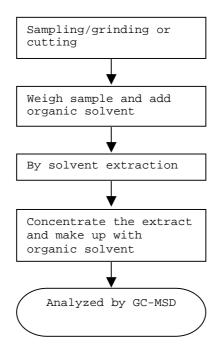




Test Conducted

## ( ${ m IV}$ ) Measurement Flowchart:

Test For Phthalates Contents Reference Method: EN 14372: 2004



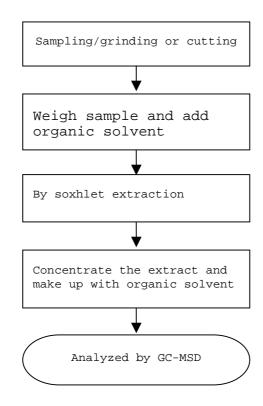




Test Conducted

# (IV) Measurement Flowchart:

Test For Hexabromocyclododecane (HBCDD) Reference Standard: USEPA 3540C



End of Report

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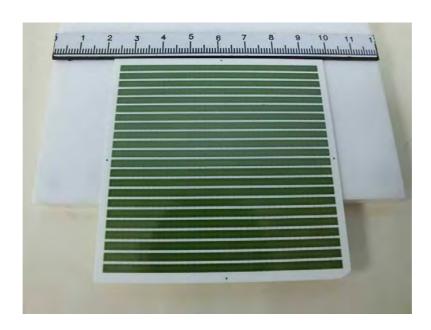


Test Conducted

Number: TWNC00286468

#### Photo





Page 10 of 10

# Intertek Testing Services Taiwan Ltd.



Number: TWNC00290385 Test Report

Littelfuse Philippines Inc. Applicant: Date : Dec 19, 2012

LIMA Technology Center, Lipa City,

Malvar, Batangas

Sample Description:

One (1) group of submitted samples said to be :

Part Description : Underglaze (Dielectric) Paste (Sintered)

: 011004 Part Number

Date Sample Received : Dec 11, 2012 Date Test Started : Dec 12, 2012

Test Conducted :

As requested by the applicant, for details please refer to attached pages.

Authorized by: On Behalf of Intertek Testing Services Taiwan Limited



K. Y. Liang Director





## Test Conducted

# ( I ) Test Result Summary :

	Result (ppm)
<u>Test Item</u>	Submitted samples
Heavy Metal	
Cadmium (Cd) content	ND
Lead (Pb) content	ND
Mercury (Hg) content	ND
Chromium VI (Cr <sup>6+</sup> ) content	ND
Polybrominated Biphenyls (PBBs)	
Monobrominated Biphenyls (MonoBB)	ND
Dibrominated Biphenyls (DiBB)	ND
Tribrominated Biphenyls (TriBB)	ND
Tetrabrominated Biphenyls (TetraBB)	ND
Pentabrominated Biphenyls (PentaBB)	ND
Hexabrominated Biphenyls (HexaBB)	ND
Heptabrominated Biphenyls (HeptaBB)	ND
Octabrominated Biphenyls (OctaBB)	ND
Nonabrominated Biphenyls (NonaBB)	ND
Decabrominated Biphenyl (DecaBB)	ND
Polybrominated Diphenyl Ethers (PBDEs)	
Monobrominated Diphenyl Ethers (MonoBDE)	ND
Dibrominated Diphenyl Ethers (DiBDE)	ND
Tribrominated Diphenyl Ethers (TriBDE)	ND
Tetrabrominated Diphenyl Ethers (TetraBDE)	ND
Pentabrominated Diphenyl Ethers (PentaBDE)	ND
Hexabrominated Diphenyl Ethers (HexaBDE)	ND
Heptabrominated Diphenyl Ethers (HeptaBDE)	ND
Octabrominated Diphenyl Ethers (OctaBDE)	ND
Nonabrominated Diphenyl Ethers (NonaBDE)	ND
Decabrominated Diphenyl Ether (DecaBDE)	ND
Halogen Content	
Fluorine (F)	ND
Chlorine (Cl)	ND
Bromine (Br)	ND
Iodine (I)	ND





#### Test Conducted

## ( I ) Test Result Summary :

Test Item	Result (ppm)	
	Submitted samples	
Phthalates	·	
Di(2-ethylhexyl) Phthalate (DEHP)	ND	
Dibutyl Phthalate (DBP)	ND	
Benzyl Butyl Phthalate (BBP)	ND	
Others		
Hexabromocyclododecane (HBCDD)	ND	

Remarks: ppm = Parts per million based on weight of tested sample = mg/kg

ND = Not detected

Responsibility of Chemist : Irene Chiou / Kevin Liu / Cathy Chen

Date Sample Received : Dec 11, 2012

Test Period : Dec 12, 2012 to Dec 17, 2012

#### ( $\Pi$ ) RoHS Limits:

Restricted Substances	<u>Limits</u>
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)
Polybrominated Biphenyls (PBBs)	0.1% (1000ppm)
Polybrominated Diphenyl Ehters (PBDEs)	0.1% (1000ppm)

The above limits were quoted from Annex II of 2011/65/EU for homogeneous material.





## Test Conducted

# (Ⅲ) Test Method:

) Test Method:	M M	Daniel de la contraction de la
Test Item	<u>Test Method</u>	Reporting Limit
Cadmium (Cd) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321 edition 1.0:2008 in clause 7, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex C, by alkaline digestion and determined by UV-Vis spectrophotometer.	1 ppm
Polybrominated Biphenyls (PBBs)	With reference to IEC 62321 edition 1.0:2008 in annex A, by solvent extraction and determined by GC-MS and further HPLC-DAD confirmation when necessary.	5 ppm
Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 edition 1.0:2008 in annex A, by solvent extraction and determined by GC-MS and further HPLC-DAD confirmation when necessary.	5 ppm





## Test Conducted

# (Ⅲ) Test Method:

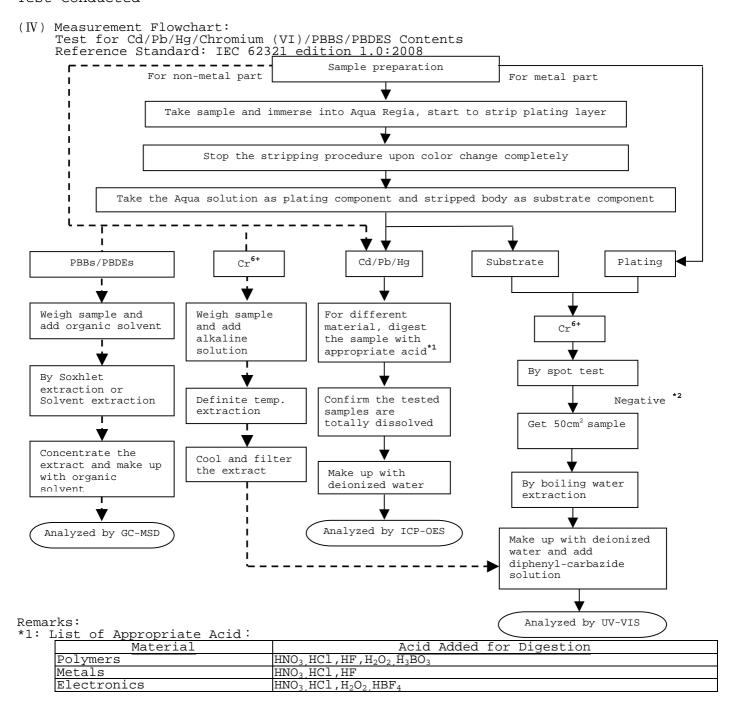
Test Item	Test Method	Reporting Limit
Halogen Content	With reference to EN 14582:2007 by calorimetric bomb with oxygen and determined by Ion Chromatograph.	50 ppm
Phthalates	With reference to EN 14372: 2004, by solvent extraction and determined by GC-MS.	50 ppm
Hexabromocyclododecane (HBCDD)	With reference to USEPA 3540C, by solvent extraction and determined by GC-MS.	10 ppm

Remark: Reporting limit = Quantitation limit of analyte in sample





## Test Conducted



\*2: If the result of spot test is positive, Chromium VI would be determined as detected.



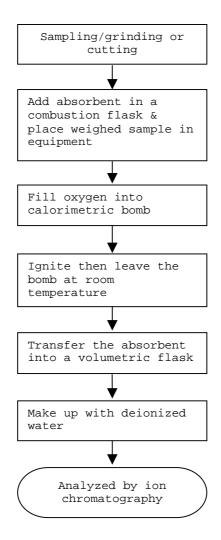
#### Intertek Testing Services Taiwan Ltd.



#### Test Conducted

#### (IV) Measurement Flowchart:

Test for Halogen Content Reference Standard: EN 14582



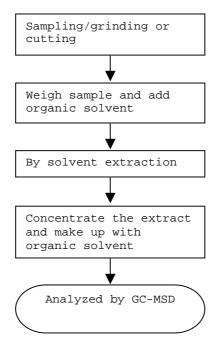




Test Conducted

### (IV) Measurement Flowchart:

Test For Phthalates Contents Reference Method: EN 14372: 2004



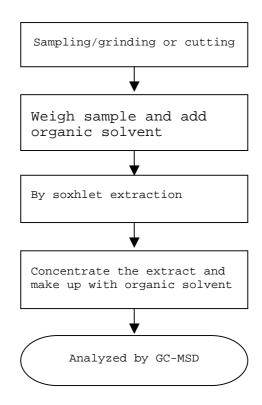




#### Test Conducted

#### (IV) Measurement Flowchart:

Test For Hexabromocyclododecane (HBCDD) Reference Standard: USEPA 3540C



End of Report

This report is made solely on the basis of your instructions and/or information and materials supplied by you. It is not intended to be a recommendation for any particular course of action. Intertek does not accept a duty of care or any other responsibility to any person other than the Client in respect of this report and only accepts liability to the Client insofar as is expressly contained in the terms and conditions governing Intertek's provision of services to you. Intertek makes no warranties or representations either express or implied with respect to this report save as provided for in those terms and conditions. We have aimed to conduct the Review on a diligent and careful basis and we do not accept any liability to you for any loss arising out of or in connection with this report, in contract, tort, by statute or otherwise, except in the event of our gross negligence or wilful misconduct.





Test Conducted

# Photo







# Intertek Testing Services Taiwan Ltd.



Number: TWNC00286469 Test Report

Littelfuse Philippines Inc. Applicant: Date : Nov 22, 2012

LIMA Technology Center, Lipa City,

Malvar, Batangas

Sample Description:

One (1) group of submitted samples said to be :

Part Description : Silver - End Termination Paste (Sintered)

: 011001 Part Number

Date Sample Received : Nov 15, 2012 Date Test Started : Nov 16, 2012

Test Conducted :

As requested by the applicant, for details please refer to attached pages.

Authorized By: On Behalf Of Intertek Testing Services Taiwan Limited



K. Y. Liang Director





# Test Conducted

# ( I ) Test Result Summary :

, rese resure summary	Result (ppm)	
Test Item	Silvery material	
Heavy Metal		
Cadmium (Cd) content	ND	
Lead (Pb) content	ND	
Mercury (Hg) content	ND	
Chromium VI (Cr <sup>6+</sup> ) content	ND	
Polybrominated Biphenyls (PBBs)	•	
Monobrominated Biphenyls (MonoBB)	ND	
Dibrominated Biphenyls (DiBB)	ND	
Tribrominated Biphenyls (TriBB)	ND	
Tetrabrominated Biphenyls (TetraBB)	ND	
Pentabrominated Biphenyls (PentaBB)	ND	
Hexabrominated Biphenyls (HexaBB)	ND	
Heptabrominated Biphenyls (HeptaBB)	ND	
Octabrominated Biphenyls (OctaBB)	ND	
Nonabrominated Biphenyls (NonaBB)	ND	
Decabrominated Biphenyl (DecaBB)	ND	
Polybrominated Diphenyl Ethers (PBDEs)		
Monobrominated Diphenyl Ethers (MonoBDE)	ND	
Dibrominated Diphenyl Ethers (DiBDE)	ND	
Tribrominated Diphenyl Ethers (TriBDE)	ND	
Tetrabrominated Diphenyl Ethers (TetraBDE)	ND	
Pentabrominated Diphenyl Ethers (PentaBDE)	ND	
Hexabrominated Diphenyl Ethers (HexaBDE)	ND	
Heptabrominated Diphenyl Ethers (HeptaBDE)	ND	
Octabrominated Diphenyl Ethers (OctaBDE)	ND	
Nonabrominated Diphenyl Ethers (NonaBDE)	ND	
Decabrominated Diphenyl Ether (DecaBDE)	ND	
Halogen Content		
Fluorine (F)	ND	
Chlorine (Cl)	ND	
Bromine (Br)	ND	
Iodine (I)	ND	





### Test Conducted

# ( I ) Test Result Summary :

Test Item	Result (ppm)	
	Silvery material	
Phthalates		
Di(2-ethylhexyl) Phthalate (DEHP)	ND	
Dibutyl Phthalate (DBP)	ND	
Benzyl Butyl Phthalate (BBP)	ND	
Others		
Hexabromocyclododecane (HBCDD)	ND	

Remarks: ppm = Parts per million based on weight of tested sample = mg/kg

ND = Not detected

Responsibility of Chemist : Irene Chiou / Kevin Liu / Cathy Chen

Date Sample Received : Nov 15, 2012

Test Period : Nov 16, 2012 to Nov 21, 2012

### ( $\coprod$ ) RoHS Limits:

Restricted Substances	<u>Limits</u>
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)
Polybrominated Biphenyls (PBBs)	0.1% (1000ppm)
Polybrominated Diphenyl Ehters (PBDEs)	0.1% (1000ppm)

The above limits were quoted from Annex II of 2011/65/EU for homogeneous material.





# Test Conducted

# (Ⅲ) Test Method:

Test Item	Test Method	Reporting Limit
Cadmium (Cd) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321 edition 1.0:2008 in clause 7, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex C, by alkaline digestion and determined by UV-Vis spectrophotometer.	1 ppm
Polybrominated Biphenyls (PBBs)	With reference to IEC 62321 edition 1.0:2008 in annex A, by solvent extraction and determined by GC-MS and further HPLC-DAD confirmation when necessary.	5 ppm
Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 edition 1.0:2008 in annex A, by solvent extraction and determined by GC-MS and further HPLC-DAD confirmation when necessary.	5 ppm





# Test Conducted

# (Ⅲ) Test Method:

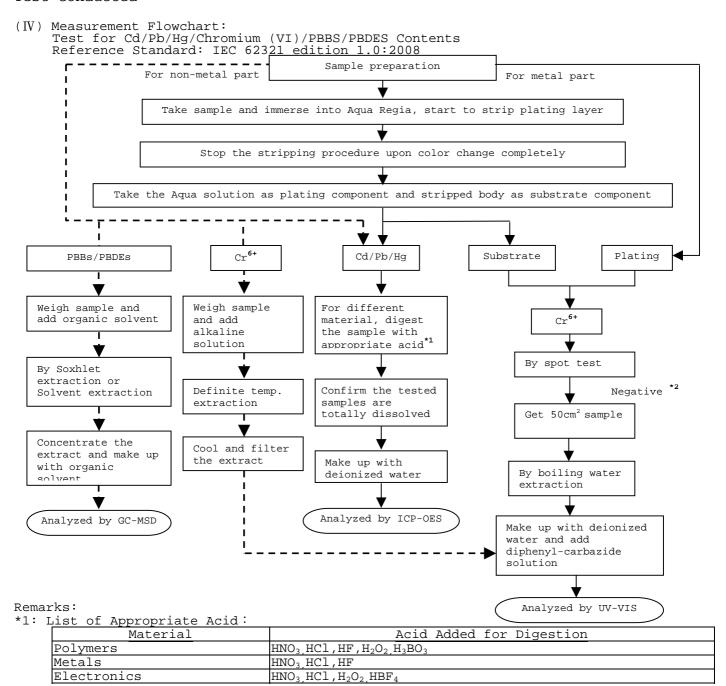
Test Item	Test Method	Reporting Limit
Halogen Content	With reference to EN 14582:2007 by calorimetric bomb with oxygen and determined by Ion Chromatograph.	50 ppm
Phthalates	With reference to EN 14372: 2004, by solvent extraction and determined by GC-MS.	50 ppm
Hexabromocyclododecane (HBCDD)	With reference to USEPA 3540C, by solvent extraction and determined by GC-MS.	10 ppm

Remark: Reporting limit = Quantitation limit of analyte in sample





# Test Conducted



\*2: If the result of spot test is positive, Chromium VI would be determined as detected.



# Intertek Testing Services Taiwan Ltd.

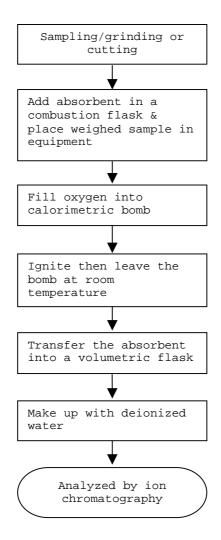
8F., No. 423, Ruiguang Rd., Neihu District, Taipei 114, Taiwan, R.O.C. 全國公證檢驗股份有限公司



### Test Conducted

### (IV) Measurement Flowchart:

Test for Halogen Content Reference Standard: EN 14582



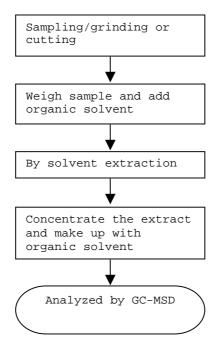




Test Conducted

### (IV) Measurement Flowchart:

Test For Phthalates Contents Reference Method: EN 14372: 2004



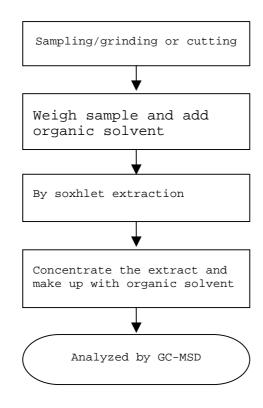




#### Test Conducted

### (IV) Measurement Flowchart:

Test For Hexabromocyclododecane (HBCDD) Reference Standard: USEPA 3540C



End of Report

This report is made solely on the basis of your instructions and/or information and materials supplied by you. It is not intended to be a recommendation for any particular course of action. Intertek does not accept a duty of care or any other responsibility to any person other than the Client in respect of this report and only accepts liability to the Client insofar as is expressly contained in the terms and conditions governing Intertek's provision of services to you. Intertek makes no warranties or representations either express or implied with respect to this report save as provided for in those terms and conditions. We have aimed to conduct the Review on a diligent and careful basis and we do not accept any liability to you for any loss arising out of or in connection with this report, in contract, tort, by statute or otherwise, except in the event of our gross negligence or wilful misconduct.





Test Conducted

# Photo









Number: TWNC00286465 Test Report

Littelfuse Philippines Inc. Applicant: Date : Nov 22, 2012

LIMA Technology Center, Lipa City,

Malvar, Batangas

Sample Description:

One (1) group of submitted samples said to be :

Part Description : Nickel Anode

: 010118 Part Number

Date Sample Received : Nov 15, 2012 Date Test Started : Nov 16, 2012

Test Conducted :

As requested by the applicant, for details please refer to attached pages.

Authorized By: On Behalf Of Intertek Testing Services Taiwan Limited



K. Y. Liang Director





#### Test Conducted

### (I) Test Result Summary:

Test Item	Result (ppm) Silvery Metal
Heavy Metal	
Cadmium (Cd) content	ND
Lead (Pb) content	ND
Mercury (Hg) content	ND
Chromium VI ( $Cr^{6+}$ ) content ( $mg/kg$ with $50cm^2$ )	Negative (< 0.02)(#)

Remarks: ppm = Parts per million based on weight of tested sample = mg/kg

ND = Not detected

< = Less than</pre>

mg/kg with 50cm<sup>2</sup> = milligram per kilogram with 50 square centimetre
Negative = A negative test result indicated positive observation
was not found at the time of Test.

# = Due to the insufficient sample area, reduced total sample surface of 10 cm<sup>2</sup> was used and the dilution factor was adjusted accordingly.

Responsibility of Chemist : Irene Chiou / Kevin Liu

Date Sample Received : Nov 15, 2012

Test Period : Nov 16, 2012 To Nov 21, 2012

#### (Ⅱ) RoHS Limits:

Restricted Substances	Limits
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)

The above limits were quoted from Annex II of 2011/65/EU for homogeneous material.





# Test Conducted

# (Ⅲ) Test Method:

Test Item	Test Method	Reporting Limit
Cadmium (Cd) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321 edition 1.0:2008 in clause 7, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex B, by boiling water extraction and determined by UV-Vis Spectrophotometer.	0.02 mg/kg with 50cm <sup>2</sup>

Remark: Reporting limit = Quantitation limit of analyte in sample



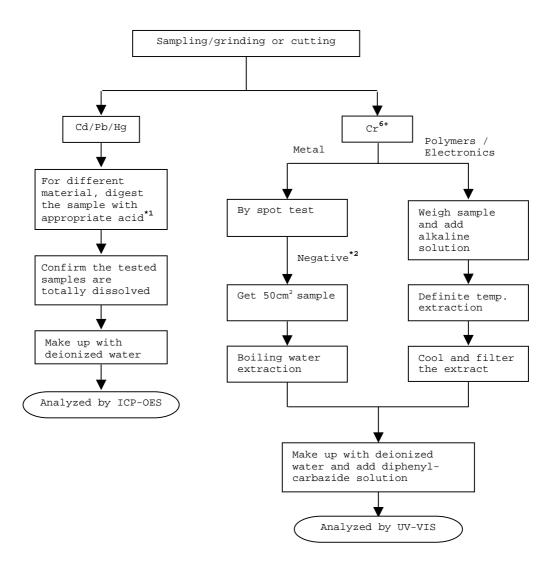


### Test Conducted

(IV) Measurement Flowchart:

Test For Cd/Pb/Hg/Chromium (VI)

Reference Standard: IEC 62321 edition 1.0:2008







#### Test Conducted

#### Remarks:

\*1: List of Appropriate Acid:

<u>Material</u>	Acid Added for Digestion
Polymers	HNO <sub>3</sub> ,HCl,HF,H <sub>2</sub> O <sub>2</sub> ,H <sub>3</sub> BO <sub>3</sub>
Metals	HNO <sub>3,</sub> HCl,HF
Electronics	HNO <sub>3,</sub> HCl,H <sub>2</sub> O <sub>2,</sub> HBF <sub>4</sub>

\*2: If the result of spot test is positive, Chromium VI would be determined as detected.

End of Report

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Test Conducted

# Photo









Number: TWNC00290384 Test Report

Littelfuse, S.A. de C.V. Applicant:

> Blvd. Fausto Z. Martinez #1800 Col. Magisterio Seccion 38 C.P. 26070 Piedra Negras, Coahuila,

Mexico

Sample Description:

One (1) group of submitted samples said to be :

Part Description : Tin Anode Part Number : 010119

: Dec 11, 2012 Date Sample Received : Dec 12, 2012 Date Test Started

Test Conducted :

As requested by the applicant, for details please refer to attached pages.

Authorized by: On Behalf of Intertek Testing Services Taiwan Limited



K. Y. Liang Director



Date : Dec 19, 2012



#### Test Conducted

#### ( I ) Test Result Summary :

j rede nedare bannarj		
Togt Itom	Result (ppm)	
<u>Test Item</u>	Silvery Metal	
Heavy Metal		
Cadmium (Cd) content	ND	
Lead (Pb) content 7		
Mercury (Hg) content	ND	
Chromium VI ( $Cr^{6+}$ ) content ( $mg/kg$ with $50cm^2$ )	Negative	
differential vi (di ) defrecité (mg/fig wiell soem )	(< 0.02)(#)	

Remarks: ppm = Parts per million based on weight of tested sample = mg/kg

ND = Not detected

< = Less than</pre>

mg/kg with 50cm<sup>2</sup> = milligram per kilogram with 50 square centimetre Negative = A negative test result indicated positive observation was not found at the time of Test.

# = Due to the insufficient sample area, reduced total sample surface of 10 cm<sup>2</sup> was used and the dilution factor was adjusted accordingly.

Responsibility of Chemist : Irene Chiou / Kevin Liu

Date Sample Received : Dec 11, 2012

Test Period : Dec 12, 2012 To Dec 14, 2012

# ( $\Pi$ ) RoHS Limits:

Restricted Substances	<u>Limits</u>
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)

The above limits were quoted from Annex II of 2011/65/EU for homogeneous material.





# Test Conducted

# (Ⅲ) Test Method:

Test Item	Test Method	Reporting Limit
Cadmium (Cd)	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321 edition 1.0:2008 in clause 7, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex B, by boiling water extraction and determined by UV-Vis Spectrophotometer.	0.02 mg/kg with 50cm <sup>2</sup>

Remark: Reporting limit = Quantitation limit of analyte in sample



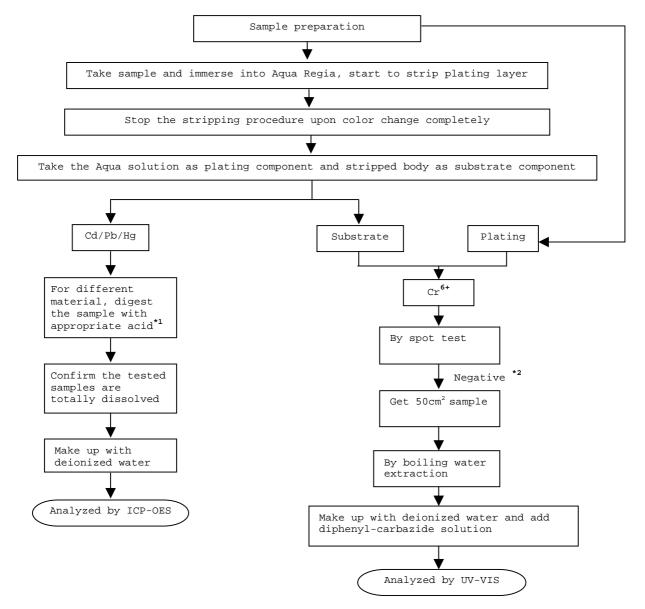


#### Test Conducted

(IV) Measurement Flowchart:

Test For Cd/Pb/Hg/Chromium (VI)

Reference Standard: IEC 62321 edition 1.0:2008







#### Test Conducted

#### Remarks:

### \*1: List Of Appropriate Acid:

Material	Acid Added For Digestion
Polymers	HNO <sub>3,</sub> HCl, HF, H <sub>2</sub> O <sub>2,</sub> H <sub>3</sub> BO <sub>3</sub>
Metals	HNO <sub>3,</sub> HCl,HF
Electronics	HNO <sub>3,</sub> HCl,H <sub>2</sub> O <sub>2,</sub> HBF <sub>4</sub>

\*2: If the result of spot test is positive, Chromium VI would be determined as detected.

End of Report

This report is made solely on the basis of your instructions and/or information and materials supplied by you. It is not intended to be a recommendation for any particular course of action. Intertek does not accept a duty of care or any other responsibility to any person other than the Client in respect of this report and only accepts liability to the Client insofar as is expressly contained in the terms and conditions governing Intertek's provision of services to you. Intertek makes no warranties or representations either express or implied with respect to this report save as provided for in those terms and conditions. We have aimed to conduct the Review on a diligent and careful basis and we do not accept any liability to you for any loss arising out of or in connection with this report, in contract, tort, by statute or otherwise, except in the event of our gross negligence or wilful misconduct.





Test Conducted

# Photo







### Intertek Testing Services Taiwan Ltd.