Pb-Free & RoHS

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KOA's Pb-Free & RoHS Compliance Statement

KOA Speer's worldwide policy has always been to take good care of humanity and to pay attention to the natural environment. Due to environmental concerns around the world, the need for lead-free solutions in electronic components is moving to the forefront within the electronics industry as a result of the Restriction of Hazardous Substance (RoHS) directive. KOA Speer is pleased to inform customers that none of our products contain: Polybrominated Biphenyls (PBB), Polybrominated Diphenyl Ethers (PBDE), Hexavalent Chromium, Cadmium, or Mercury and are RoHS compliant. KOA is providing a parallel system in which we are continuing to offer the standard SnPb terminations as well as the new lead-free solutions. In addition, all of the product series listed below are offered in lead-free and meet all RoHS standards. All our parts are still compatible with 260 degree C soldering, and can be ordered using the lead-free termination code (A, C, D & T). Detailed ordering information can be found in our catalog or on our web site (www.koaspeer.com).

KOA Speer looks forward to working with customers to provide the most cost-effective and reliable lead-free solution for your needs.

AA(X)	CR(X)	KC	MCR	PCF	RN41/RM41	TLR
AC(X)	CSR	KCR	MF	PT72	RN73	TMC
AP(X)	CTX	KGM	MFS	RBA	RNS	TMH
C4000	CW/CWP	KL32	MHL	RC	RTX	TMR
CC	CZB	KL73	MLT	RC1/4,RC1/2	RTY	TMU
CCF	CZP	KQ/KQT	MO	RCR	SDR	TMX
CCP	DN2-DN8	KQC	MOS	RD41	SDS	UR73
CF	DNA	LA73	MRP	RDA	SG73	USD
CN/CN_A/CN_K	EA(X)	LFA	MRS	RDB	SL1/SL2/SL3/TSL	USU
CNB	EDA	LPC	NPO/X5R/X7R	RF73	SPR	Y5V/Z5U
CND	EDB	LR72	NPR	RIA	SR73	Z/J
CNZ	FBA	LT	NT73	RK73	TF	
CPCN	HFC	LT73	NV73	RKC/RKH/RKL	TFA	
CR	JL	MCL	NVD	RN26/RNF26/RK26	TFB	

KOA's Environmental Policy

1. **Origin**

   How can we live in harmony with mother earth?

2. **Philosophy**

   KOA was established and grew up in Ina Valley to provide the environment where farmers can live as farmers.
   Meanwhile, as we engage in electronic component production, we - as one of living creatures of earth - continuously learn about our association with soil, water and sun to build "trust" with the earth.
   Each member of KOA group companies is concerned about life cycle of water that surrounds us, and strives to create a model for circulatory society in our hometown by implementing "Father Sun" (Environmental Management System) through self-imposed responsibility.

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3. **Policy**

(1) We shall accurately grasp how KOA's business activities affect the environment to establish "Father Sun" (Environmental Management System) and try to continuously improve "Father Sun" as we strive to prevent the environmental pollution.

(2) All members of KOA shall take actions in consideration of natural environment under the environmental management manual in compliance with relevant environmental legislations and regulations, and other requirements, as well as self-imposed standards.

(3) We shall conduct environmental internal audit and strive to continuously improve "Father Sun" through self-imposed control.

(4) This environmental policy shall be applied to KOA and all KOA Group entities.

Further explanation of Pb in glass of electronics components – mainly thick film chip resistors which have a glass passivation layer protecting the resistive element.

RoHS / Article 4 / "Prevention"

(1) Member States shall ensure that, from 1 July 2006, new electrical electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE). National measures restricting or prohibiting the use of these substances in electrical and electronic equipment which were adopted in line with Community legislation before the adoption of this Directive may be maintained until 1 July 2006.

(2) Paragraph 1 shall be not apply to the applications listed in the Annex.

(3) (Abbreviating later)

Annex

Applications of lead, mercury, cadmium and hexavalent chromium, which are exempted from the requirements of Article 4(1) (The text which it is related to the lead)

(5) Lead in glass of cathode ray tubes, electronic components and fluorescent tubes.

(6) Lead as an alloying element in steel containing up to 0.35% lead by weight, aluminium containing up to 0.4% lead by weight and as a copper alloy containing up to 4% lead by weight.

(7) - lead in high melting temperature type solders (i.e. tin-lead solder alloys containing more than 85% lead),
- lead in solders for servers, storage and storage array systems (exemption granted until 2010),
- lead in solders for network infrastructure equipment for switching, signaling, transmission as well as network management for telecommunication,
- lead in electronic ceramic parts (e.g. piezoelectronic devices).

"Products with Pb-free terminations meet RoHS requirements' is stated for several products in this catalog. All those products with the statement meet the RoHS requirements explained in above regulation in the square. However please be reminded that RoHS regulations is not intended for Pb-glass contained in electrode, resistor element, glass coating etc."

Pb-Free and RoHS Compliance Labeling

KOA Speer Electronics will be labeling all products per **JEITA-ETR-7021**. (Pb-free/RoHS compliant parts will be marked as "ECO" & SnPb parts will be marked "Pb".

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Copy of KOA Through Hole Pb-free PCN Letter Dated January 31, 2005.

As everyone is well aware, the electronic industry is moving towards the elimination of Lead (Pb) and other hazardous materials. This is mainly driven by environmental concerns and largely supported by upcoming legislation (EU directives on Waste Electrical and Electronic Equipment – WEEE, and Restriction of Hazardous Substances – RoHS). The present deadline imposed by the EU Directive RoHS is July 1, 2006.

Due to this "Green" movement in the industry, lead wire for through-hole components containing Lead (Pb) has become very scarce. More and more lead wire suppliers are discontinuing the use of Lead (Pb) in their products. This has forced KOA to change the solder finish on the through-hole components from Tin Lead (SnPb) to Tin Copper (SnCu). The new finish will be 98.8% Sn and 1.2% Cu. Pb-Free products are reverse compatible with present lead-based solder systems and reflow profiles, as well as forward compatible with emerging Pb-Free solder systems.

Effective January 31, 2006, the standard through-hole product offered by KOA will be Pb-free (SnCu) with a transition period starting August 1, 2005. Between August 1, 2005 and January 31, 2006, without a transition date agreement between KOA and the customer, shipments may be either SnPb or SnCu (reference the KOA Speer Electronics, Inc. web site – www.koaspeer.com – for the proper part numbering designations for both SnPb and the Pb-free equilivant). These shipments will also be clearly marked on the customer specific labels as follows – SnPb product will be marked as "PB" and Pb-free (SnCu) product will be marked as "ECO". If the August 1, 2005 date cannot be accepted by any customer, written notification must be submitted to KOA by April 29, 2005. The written notification can be emailed to djohnston@koaspeer.com. If written notification is received, the transition date can be changed to any date between August 1, 2005 and January 31, 2006 as agreed upon by KOA and the customer. After January 31, 2006, the standard through-hole product will be Pb-free (SnCu), however KOA will still offer SnPb through-hole product as a specialty (NCNR) and at a premium.

The KOA product lines affected by this Pb-free transition are as follows:

MF	MFS	MS	RNS	Z
J-Z	JLT	LT	CF	CFP
SPR	SPRX	RCR	PCF	HPC
MO	MOX	MOS	MOSX	CW
CWP	RKL	RKC	RKH	MFP
SNF	RK	GS	SF	RN
RNC	RW	NRW	BGR	BWR
BSR	BPR	LR	RF	RF26
RF25_C	WF	LP	LHB	RLH
PCV	PCH	TR	PCA	BDC
WB	SA	SF	UF	SDT101
SDT301	NVD	MRP	MRG	MRGMA
LF	LFF	RK26	RK92	MRH
MRHL	MRS	MF	LR	C4000
SF6	SF8			

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Copy of KOA Tantalum Chip Capacitor Pb-free PCN Letter Dated March 7, 2005.

As everyone is well aware, the electronic industry is moving towards the elimination of Lead (Pb) and other hazardous materials. This is mainly driven by environmental concerns and largely supported by upcoming legislation (EU directives on Waste Electrical and Electronic Equipment – WEEE, and Restriction of Hazardous Substances – RoHS). The present deadline imposed by the EU Directive RoHS is July 1, 2006.

Effective March 7, 2005 - all TMC, TMR TMH, TMU, TMX and TDR sample orders will be supplied as Pb-Free Product and should be ordered as such.

Effective April 1, 2005 - all items with no-inventory position will be supplied as Pb-Free Product.

Pb-Free products are reverse compatible with present lead-based solder systems and reflow profiles, as well as forward compatible with emerging Pb-Free solder systems.

All tantalum chip capacitors will have 100% matte Sn terminations. A complete test and qualification package is currently available upon request, if a copy is required please contact djohnston@koaspeer.com.

The KOA product lines affected by this Pb-free transition are as follows:

TMC TMR TMH TMU TMX TDR

If you have any questions or concerns please feel free to contact your local KOA Sales Representative, any other KOA contact, or directly email Dena Johnston at djohnston@koaspeer.com. KOA Speer Electronics will continually post new information on our website.

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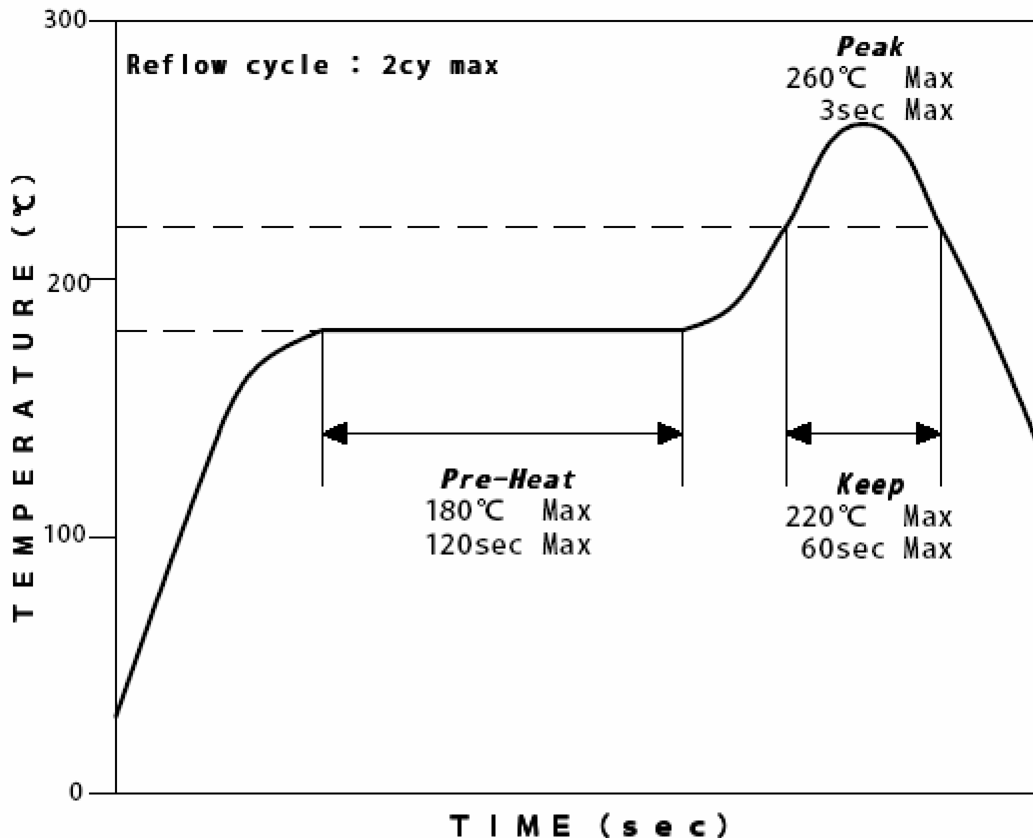
KOA Pb-Free Components Recommended Soldering Information and Profile

Reflow Profile



Flow Soldering

Maximum Solder Temperature – 260 °C
Maximum Time in Solder – 10 Seconds

Hand Soldering

A pencil type soldering of 30 watts maximum and with a diameter of 3 mm maximum should be used. The soldering iron tip temperature should be less than 300 °C and maximum contact time should be 5 seconds. The soldering iron tip should never come in contact with the component body.

KOA's Pb-Free products are reverse compatible with present lead-based solder systems and reflow profiles, as well as forward compatible with emerging Pb-Free solder systems.

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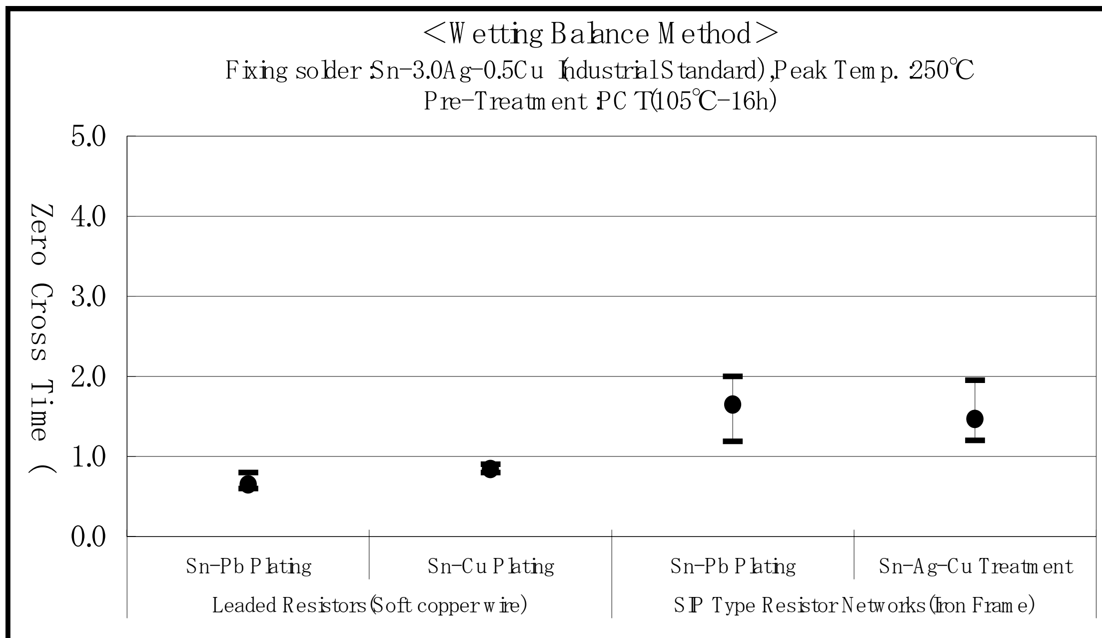
Pb-Free Through Hole Resistor Technical Data

Section 1 – All tests in Section 1 used Pb-free Solder Paste for Testing to Prove Compatibility of the Pb-Free Components vs. Pb-Free Solder Paste. The Pb-Free Solder Paste used was Sn-3Ag-0.5Cu Solder.

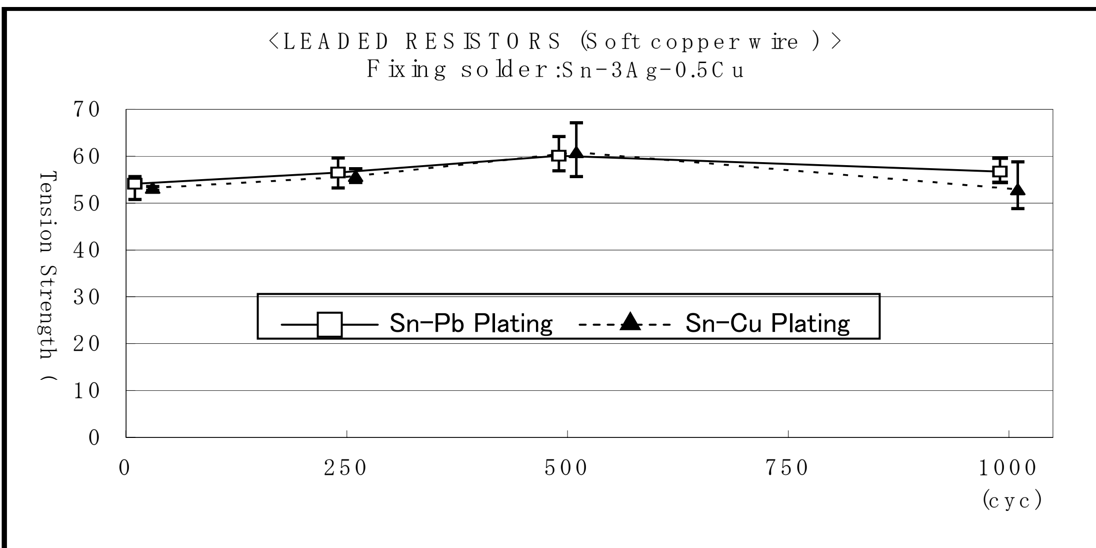
（1） Solder Wetting – Wetting Balance of Through Hole Components with Sn-3Ag-0.5Cu Solder



（2） Joining Strength

Test Conditions：Temperature cycling of -55C（30min.）／+125C（30min.）

Joining Strength of Lead Wire Type



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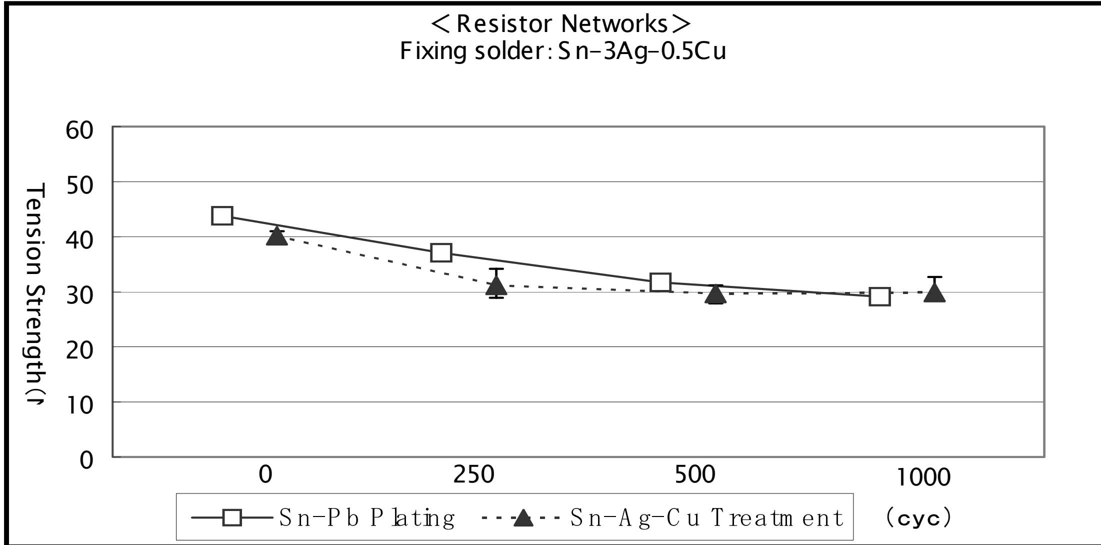
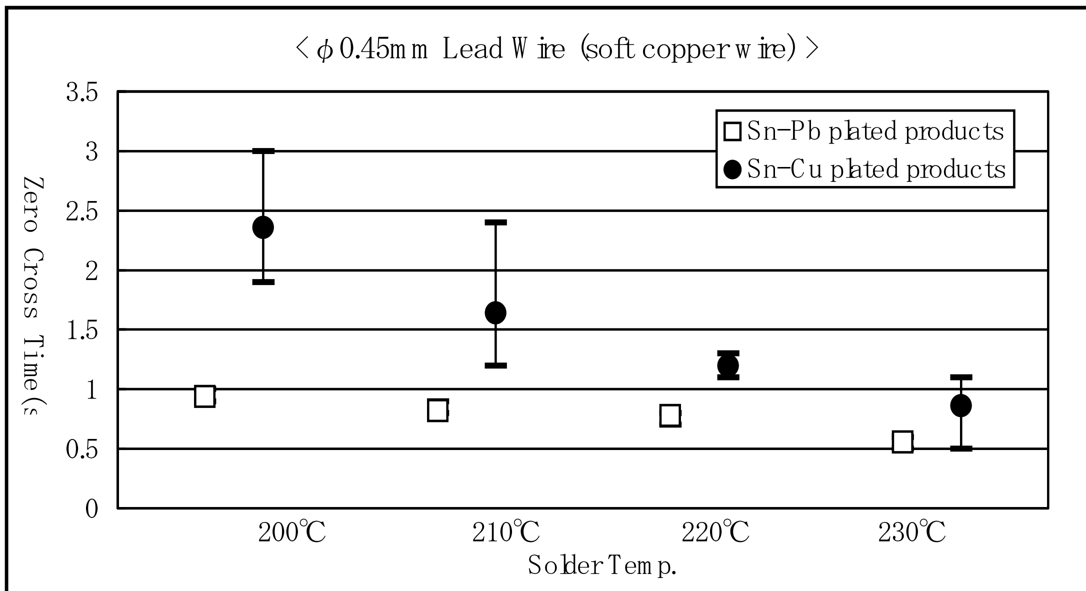
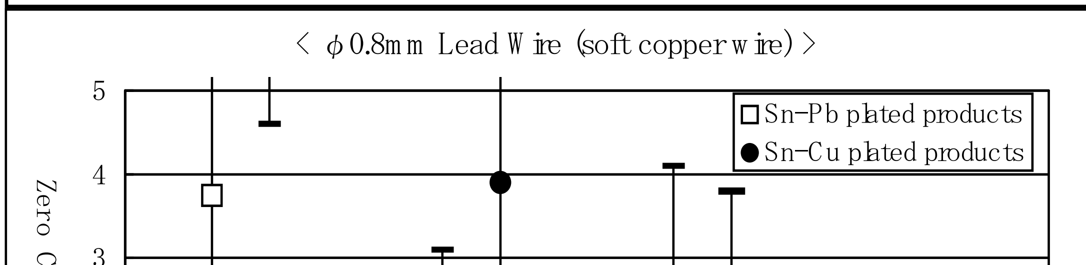


Section 2 – All tests in Section 1 used SnPb Solder Paste for Testing to Prove Compatibility of the Pb-Free Components vs. SnPb Solder Paste. The SnPb Solder Paste used was Sn-40Pb Solder.

（1） Solder Wetting – Wetting Balance of Through Hole Components with Sn-40Pb Solder





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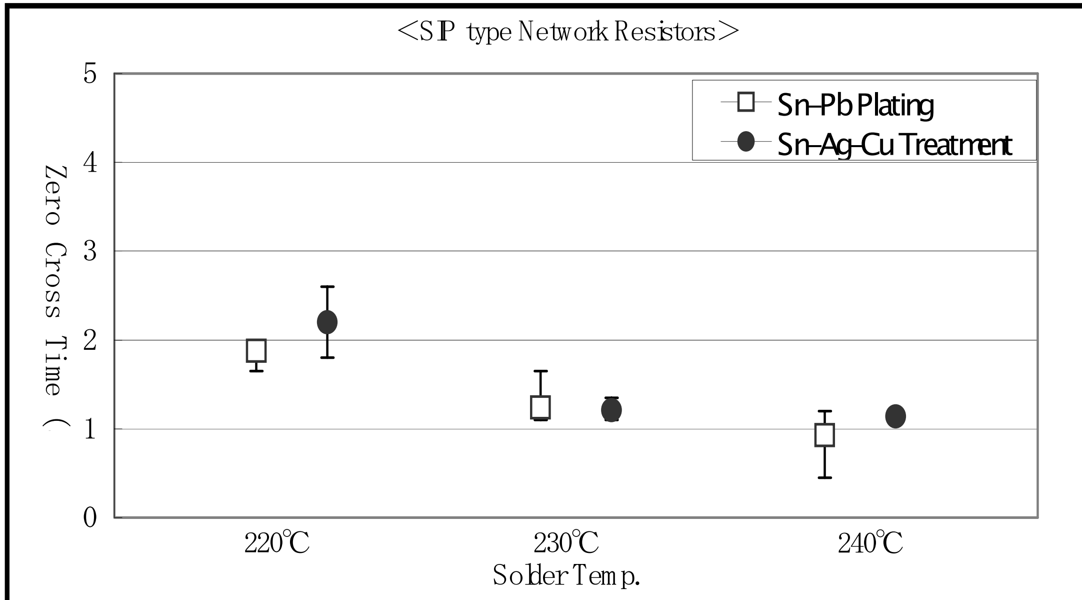

（2）Joining Strength

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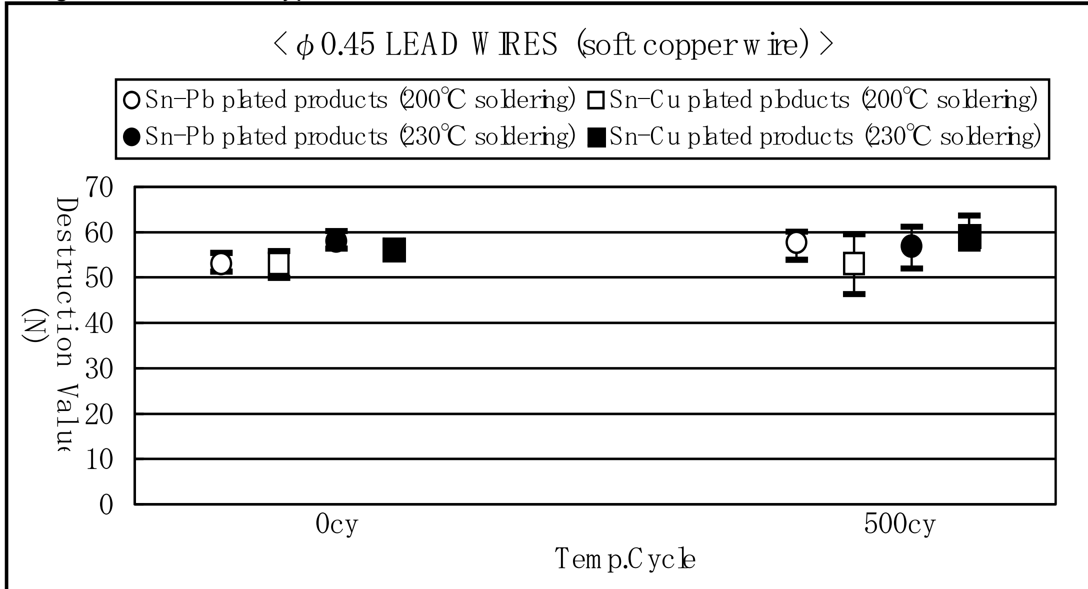
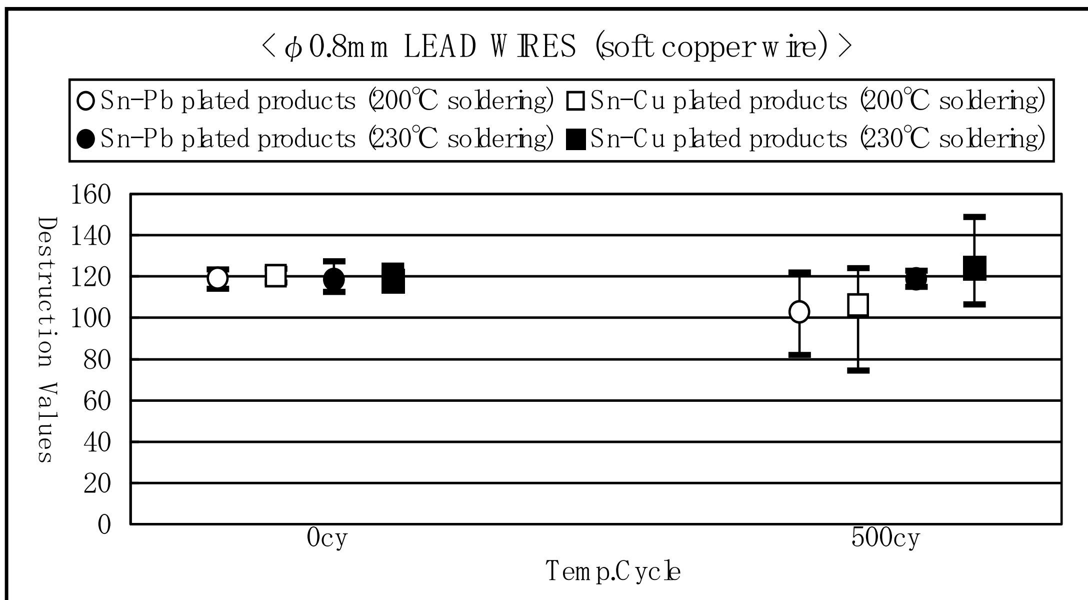
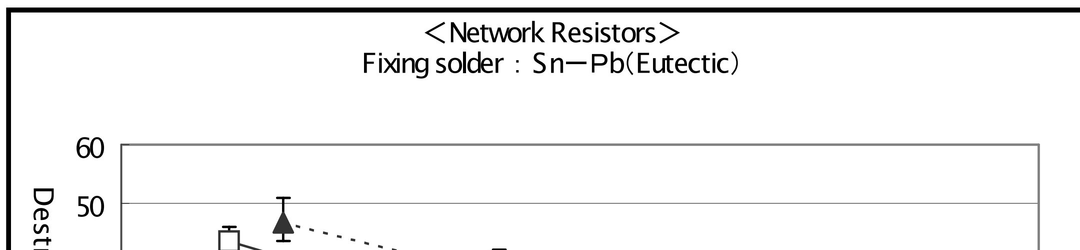
Test Conditions：Temperature cycling of -55C（30min.）／+125C（30min.）

Joining Strength of Lead Wire Type







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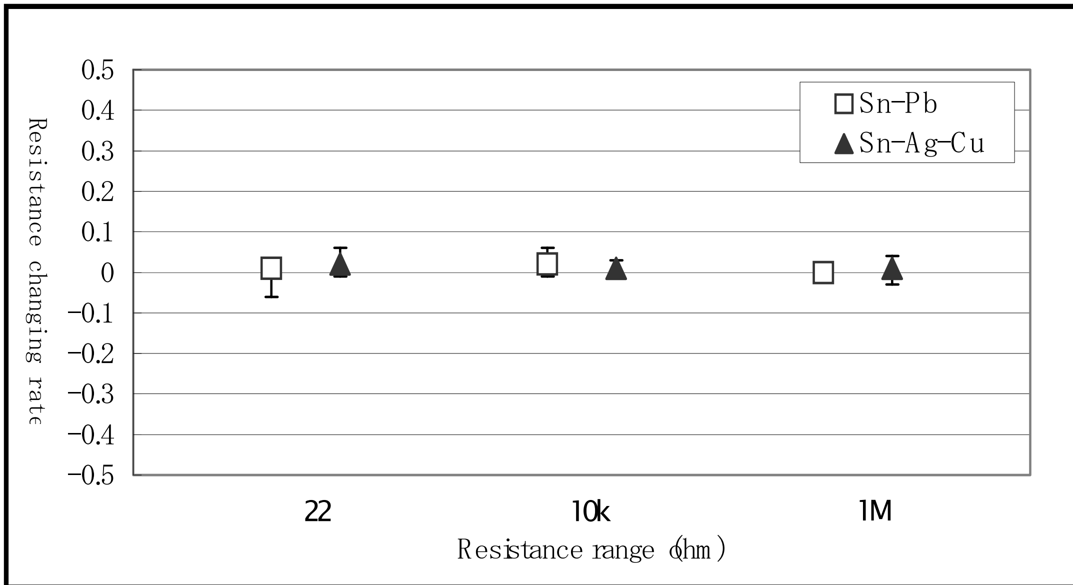
（3） Terminal Connection Strength of SIP Type Network Resistors

Test Conditions：Application of Weight Toward Terminal Axis 9.8N/10sec.



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Temperature Cycling - per AEC-Q-200 – Reference JESD22 Method JA-104 – 1000 cycles from -55C to 125C.

Operational Life - per AEC-Q-200 – Reference MIL-STD-202 Method 108 – Condition D Steady State at 125C at rated power.

Thermal Shock - per AEC-Q-200 – Reference MIL-STD-202 Method 107 – Air to Air, 300 cycles at -55C to 125C with a dwell time of 15 minutes and maximum transfer time of 20 seconds.

Terminal Strength – per AEC-Q-200 – Reference JIS-C-6429 – Apply a force of 1.8 kg for 60 seconds.

Board Flex – per AEC-Q-200 – Reference JIS-C-6429 – 2 mm bend minimum.

Solderability – See specification below in Appendix 6.

Tin Whisker Testing – See specification below in Appendix 6.

Appendix 6

This appendix specifies the added requirements needed to address the special quality and reliability issues that arise when lead (Pb) free processing is utilized. Materials used in lead-free processing must not have any intentionally added elemental lead. This includes the (termination plating) and the board attach (solder). These new materials usually require higher board attach temperatures to yield acceptable solder joint quality and reliability. These higher temperatures will likely adversely affect the moisture sensitivity level of plastic packaged semiconductors. As a result, new, more robust mold compounds may be required.

6.1 Solderability

The qualification requirements outlined below are to act as a supplement to EIA/JESD22-B102 Solderability Test Method, as referenced in AEC-Q100, and J-STD-002 Solderability Tests for Component Leads, Terminations, Lugs, Terminals and Wires, as referenced in AEC-Q101 and AEC-Q200. A single lead-free solder solution has not been industry standardized as has eutectic tin-lead solder. For different formulations of solder, the chemistry, reflow temperatures and joint reliability may vary widely.

6.1.1 Section 1.4 of J-STD-002 and Section 4.1 of JESD22-B102 – Aging Preconditioning

Steam age preconditioning is performed before the solderability test to simulate the oxidation of the termination plating that can develop over a long storage time. This oxidation can minimize the solder coverage via pinholes, voids, porosity, nonwetting and dewetting and produce poor solder strength or poor reliability. If the supplier is unable to show the relationship of oxidation to shelf life for non-dry packed devices using lead-free termination plating, an aging preconditioning shall be performed (Category 3 of J-STD-002 or Test 21 solder conditions table of AEC-Q101, and 8 hours steam age exposure per section 4.1, condition C of JESD22-B102).

6.1.2 Section 3.2.1 of J-STD-002 and Section 2.6.2 and 2.7.4 of JESD22-B102 – Solder Material

The solder and solder paste composition shall be of two types – SnPb and Pb-Free.

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6.1.3 Section 3.2.1 of J-STD-002 and Section 2.6.2 and 4.3.3 of JESD22-B102 – Flux Material
The flux composition and activity shall be appropriate for the termination plating/solder material composition to be qualified.

6.1.4 Section 3.5.1 of J-STD-002 and Section 4.2 of JESD22-B102 – Solder Dip Temperature
A solder dip temperature of 260 +/- 5C shall be used for a dwell time of 5 +/- 0.5 seconds.

6.1.5 Section 3.5.2 Table 4 of J-STD-002 and Section 4.3.5.2 Table 2 of JESD22-B102 – Solder Contamination Control

Refer to the solder material manufacturer's recommended limits for solder bath contaminant.

6.1.6 Section 4.2.5.1.4 Table 6 of J-STD-002 and Section 3.1.2 of JESD22-B102 – IR/Convection Reflow Requirements
The temperature range of reflow temperature for the specified time shall be 250C (small area/thin) or 245C (large area/thick) as measured on the plastic package body per IPC/JEDEC J-STD-020B.

6.2 Preconditioning for Plastic Packaged Surface Mount Devices
Perform the Pb-free reflow conditions as specified in Section 4 Table 4-1 and Section 5 Table 5-2 of IPC/JEDEC J-STD-020B. These reflow conditions supplement the requirements of JEDEC JESD22-A113 for discrete devices.

6.3 Resistance to Dissolution of Metallization Test
For discrete and passive devices, perform this test per section 4.2.4 of J-STD-002 using a solder dip temperature of 260 +/- 5C.

6.4 Tin (Sn) Whisker Growth Evaluation

Tin whisker growth can occur under complex material and processing conditions when pure tin termination plating is used. This is a wearout reliability issue in that these whiskers can grow to contact adjacent terminations to cause false data pulses, intermittent failures and, in extreme circumstances, electrical overstress. No industry standard test procedure currently exists.

6.4.1 Termination Plating
If using pure tin as the termination plating, it must be deposited in a very clean environment and must display a matte finish. These conditions have been identified as major factors in minimizing tin whisker growth.

6.4.2 Tin Whisker Growth Testing
Suppliers must test for susceptibility to whisker growth during device aging. Suppliers can recommend testing for this failure mechanism. One test method that can be used for whisker growth evaluation is storing devices at 50-55C and 85% relative humidity for 1000 hours. Another test method stores devices at 50-55C in a dry environment (<5% relative humidity) for 24 hours. After each stress, the terminations shall be observed visually using a medium power (10-20X) microscope. Any termination displaying a whisker filament over 50% of the termination pitch for multi-termination devices shall constitute a failure.

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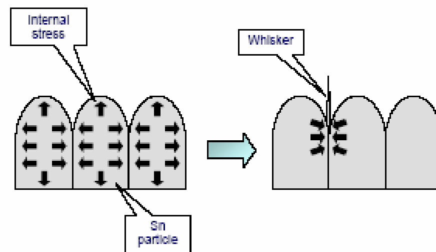
KOA currently has test data available for all case sizes of the following types of SMD resistors (available upon request): RK73, SR73, SL1, SL2 and RN73 per the above test specification.

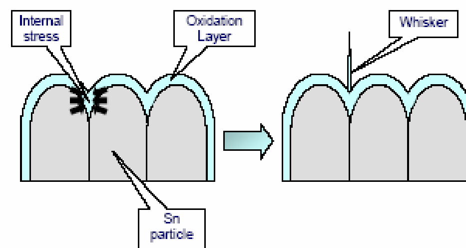
Mechanisms of Sn Whisker Formation

Research provided an insight into the mechanisms of Sn whisker formation and concluded that it results, in part, from internal stresses within the metals used for termination plating.

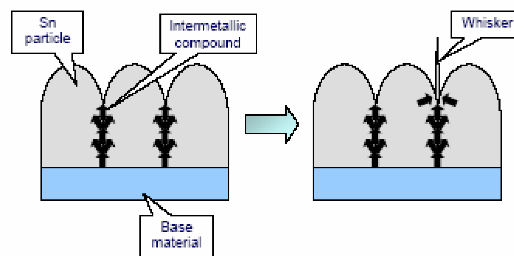
Whisker growth resulting from internal particle stresses:



Whisker growth resulting from stresses in Sn oxide layer:



Whisker growth resulting from stresses in intermetallic compounds:



KOA's engineers have been able to develop a proprietary low stress plating process which succeeds in minimising internal and intermetallic stresses and hence reduces the formation of Sn whiskers.

KOA does use a Ni barrier under the 100% matte Sn as well as controls the grain size of the Sn during the plating process in order to reduce the internal stresses and reduce the possibility of Sn whisker formation.