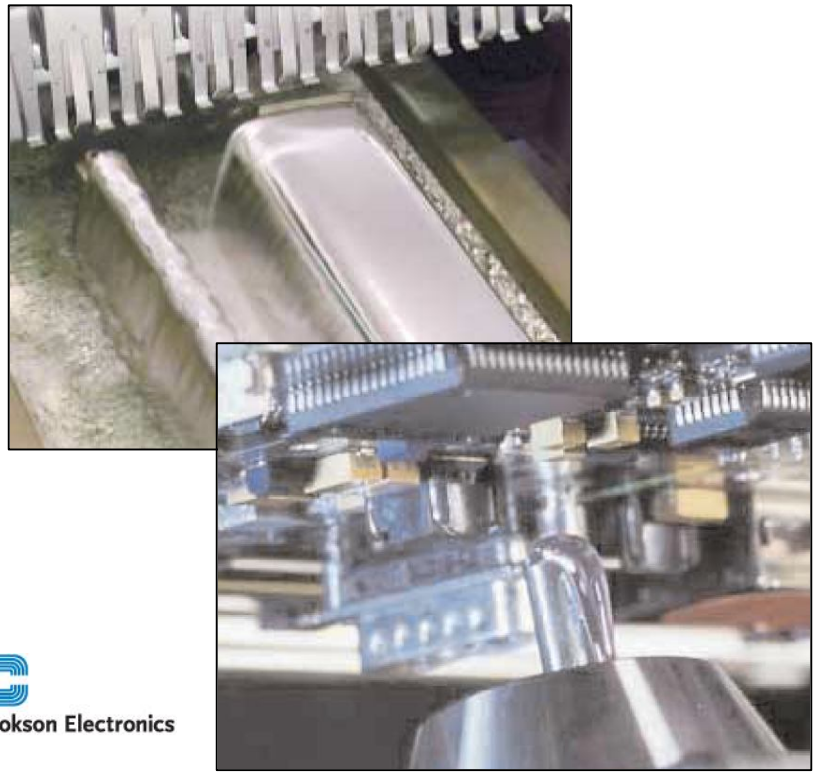
the product:

Delivering cost effective soldering performance and reliability in both Wave and Selective / Rework Soldering processes



NEW!

ALPHA® SACX™ Plus 0307

Product Guide

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Introduction

ALPHA® SACX™ Plus 0307 is the next generation of our original, and very popular, SACX®0307 alloy. **ALPHA® SACX™ Plus 0307** is engineered to deliver the same high level of soldering performance and reliability as the original but it also exhibits minimal copper erosion when subjected to the long and hot exposure times common in selective soldering and rework processes.

Like the original **ALPHA® SACX™ Plus 0307** can be dropped in to most current SAC 305 wave and selective soldering processes. All this at a cost well below the higher silver bearing SAC 305.

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ALPHA® SACX™ Plus 0307

Overview of the SACX® Family of Pb-free Alloys

The SACX Family

Alloy	Description	Availability
ALPHA® SACX® 0107	Basic alloy for use on single sided assemblies where moderate reliability in required.	Bars, wire, feeder ingots
ALPHA® SACX® 0307	Excellent soldering and reliability for either single sided or standard complexity dual sided assemblies.	Bars, wire, feeder ingots, spheres
ALPHA® SACX® 0307 Plus	Similar wave soldering performance as standard SACX®0307 but engineered to minimize copper erosion during selective soldering and rework.	Bars, wire, feeder ingots
ALPHA® SACX® 0807	Soldering performance and reliability similar to SAC305. For use on complex, dual sides assemblies where high wetting force is needed.	Bars, wire, feeder ingots
ALPHA® SACX® HASL	Designed to produce a smooth, uniform pad finish while minimizing copper erosion during plating.	Bars

- Alloys are engineered for optimal performance in specific processes or on certain types of assemblies
- Alloys are fully cross compatible
  - ➢ For example, a component can be readily soldered to a SACX™ Plus 0307 HASL finished pad using the SACX™ Plus 0807 wave solder alloy

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ALPHA® SACX™ Plus 0307

Alloy Properties

Material Property	Units	Vaculoy SACX0307 Plus
Solidus	Celsius	217
Liquidus	Celsius	228
Hardness	HV	14.1
Density	g/cc	7.33
Specific Heat Capacity	J/kg C	0.17
Stress at MAX Load (N/mm^2)	Mean	29.5
	Std Dev	0.64
Elongation at failure (%)	Mean	21.8
	Std Dev	8.8
Thermal Expansion Coefficient	(30 - 100C)/C x 10^{-6}	1.79
	(100 - 150C)/C x 10^{-6}	2.30
Silver Content	%	0.3 +0.15/-0.05
Copper Content	%	0.70 +/-0.1
Lead Content	%	Max 0.1% *

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** Ultra Low Lead (ULL) version, <0.05% Pb, also available*

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Processing Parameters

Wave Configuration	Process Parameter	Suggested Process Settings
Single Wave	Pot temperature	255 - 265 Celsius (491 - 509 F)
	Conveyor speed	1.0 - 1.5 m/min (3.3 - 5 ft/min)
	Contact time	2.3 - 2.8 seconds
	Wave Height	1/2 to 2/3 of board thickness
	Dross removal	Once per 8 hour run time
	Copper Check	Every 8,000 boards until 40,000
Dual Wave	Pot temperature	255 - 265 Celsius (491 - 509 F)
	Conveyor speed	1.0 - 1.5 m/min (3.3 - 5 ft/min)
	Contact time	3.0 - 3.5 seconds
	Wave Height	1/2 to 2/3 of board thickness
	Dross removal	Once per 8 hour run time

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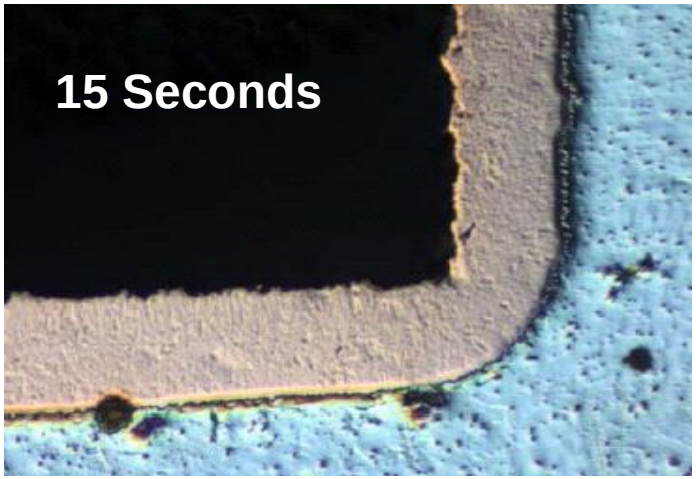
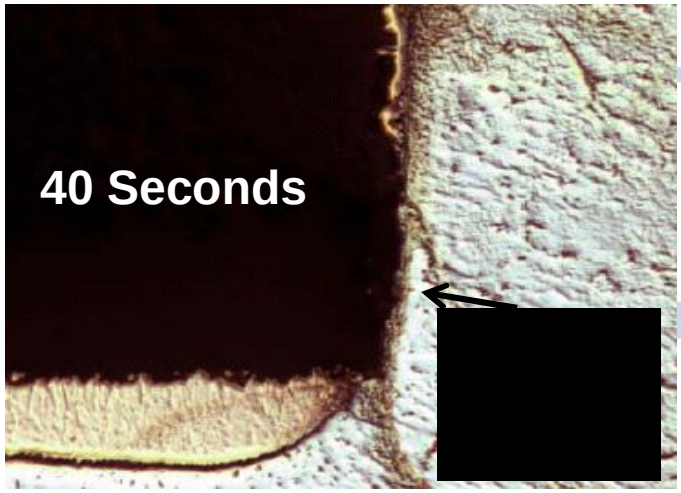
Processing Parameters – Copper Erosion

- Fountain selective soldering and rework systems, used to remove and replace components on PCBA's are normally operated at temperatures exceeding 260ºC
- This procedure can expose the copper lead and land to the molten alloy for up to 60 (or more) seconds
- High silver alloys, not engineered to reduce copper erosion, can damage the copper land or lead making the assembly defective





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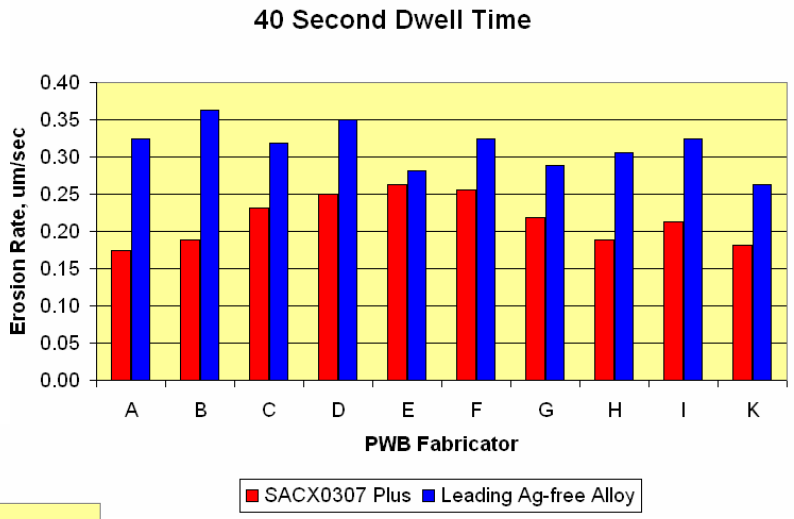
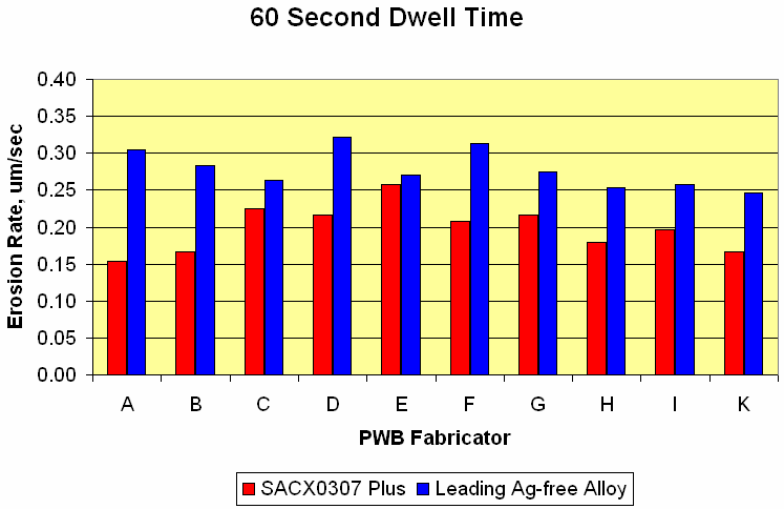
Processing Parameters

Copper Erosion

Many studies have been that demonstrate the low Cu erosion rates of SACX™ Plus 0307



Source: iNEMI Cu Erosion Study, 2007



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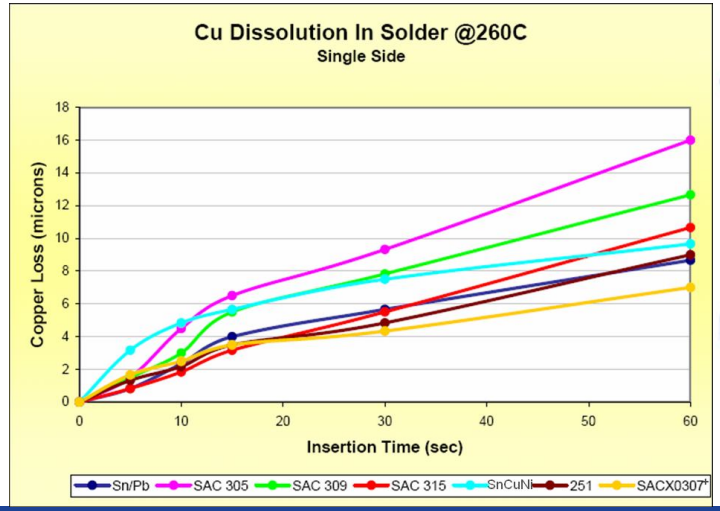
Source: Large CEM

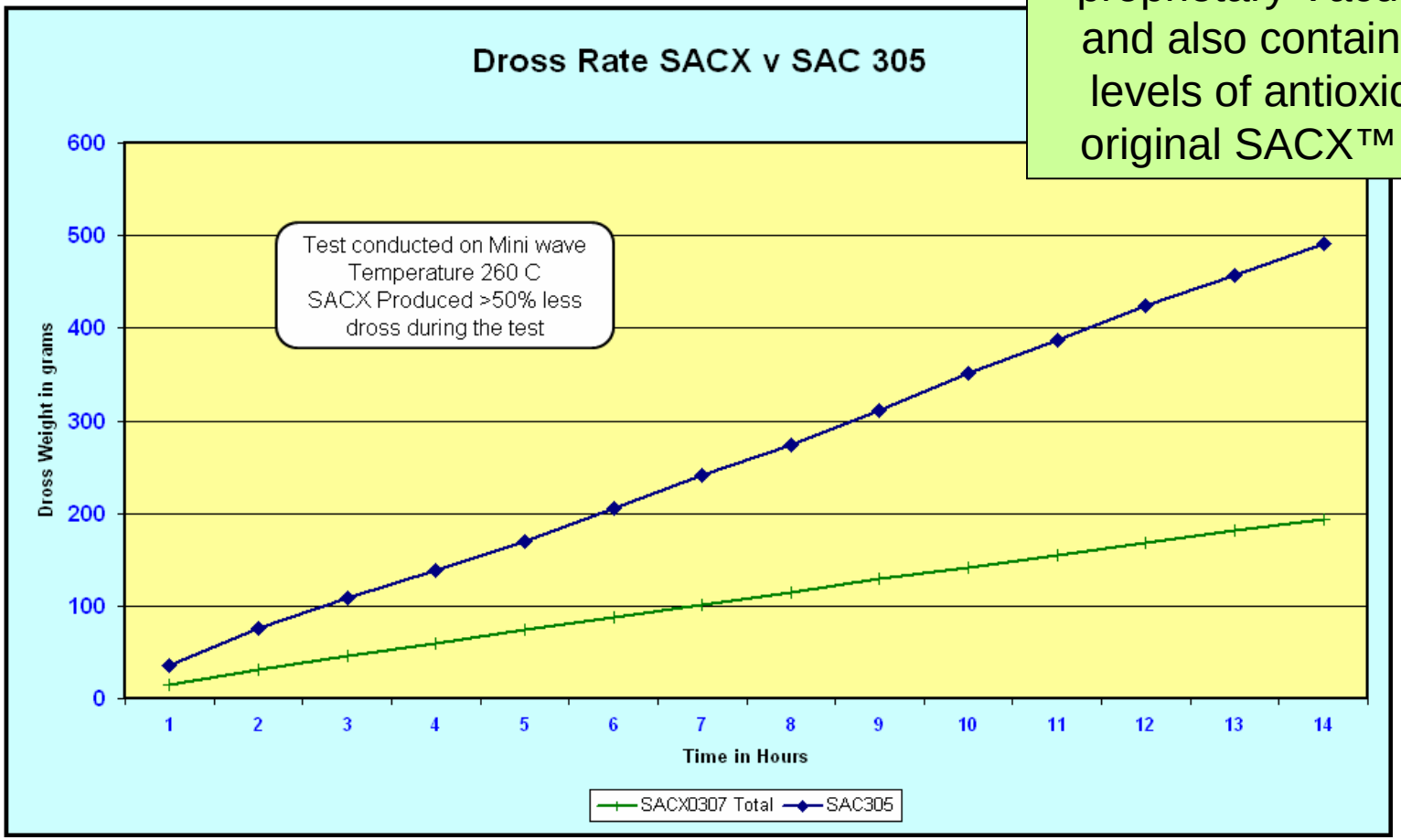


ALPHA® SACX™ Plus 0307

Processing Parameters

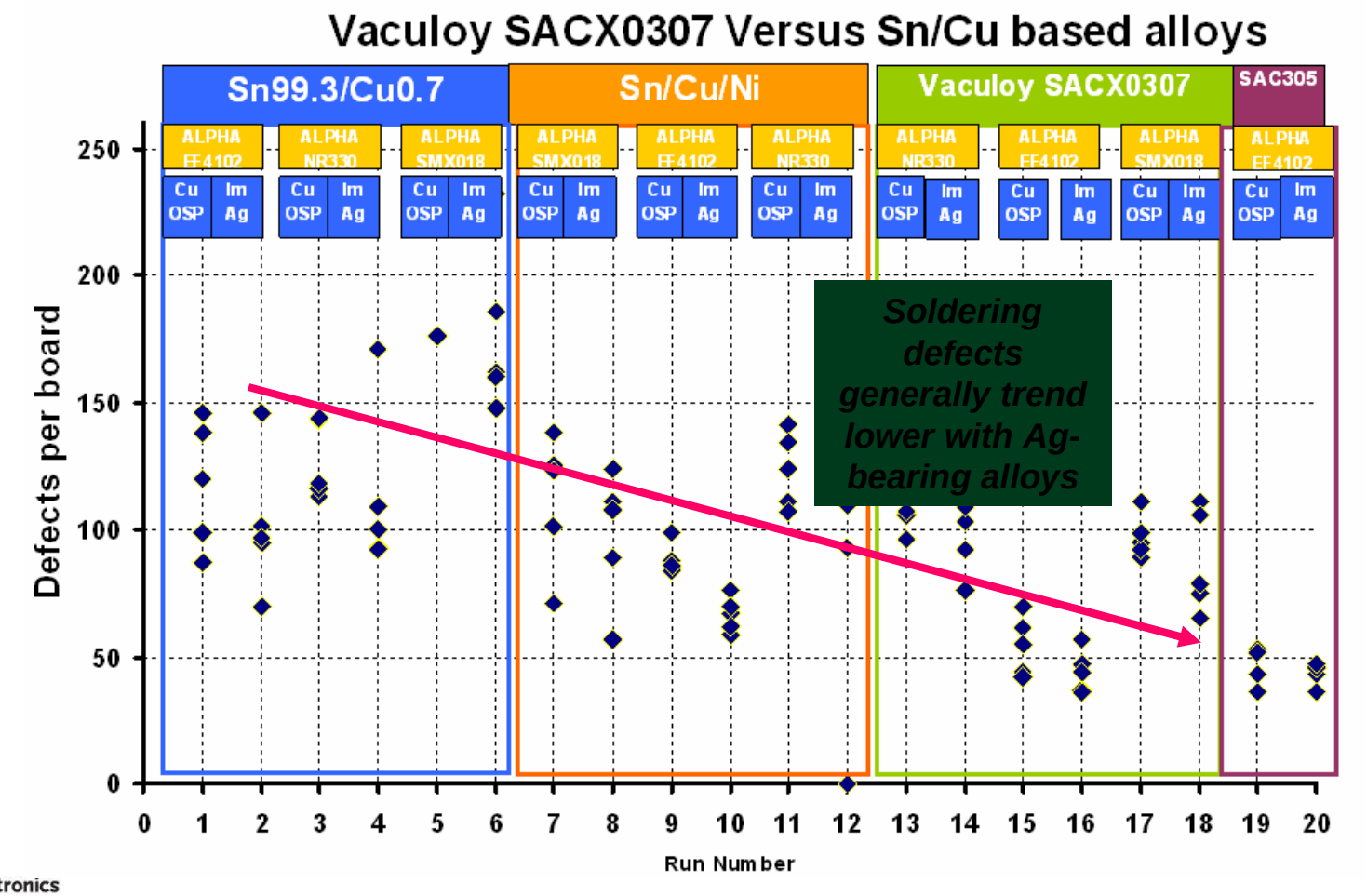
Dross Rate

ALPHA® SACX™ Plus 0307 is manufactured using Cookson's proprietary Vaculoy process and also contains the same levels of antioxidant as the original SACX™ Plus 0307.



ALPHA® SACX™ Plus 0307

Soldering Performance - General Defects *(bridges, skips, etc…)*



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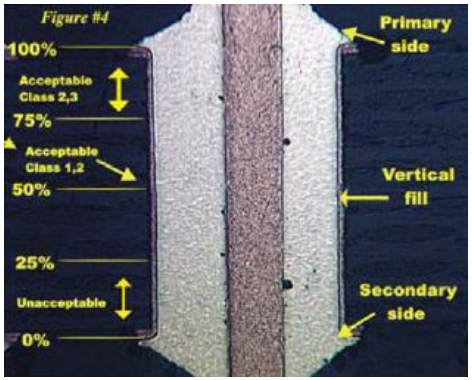
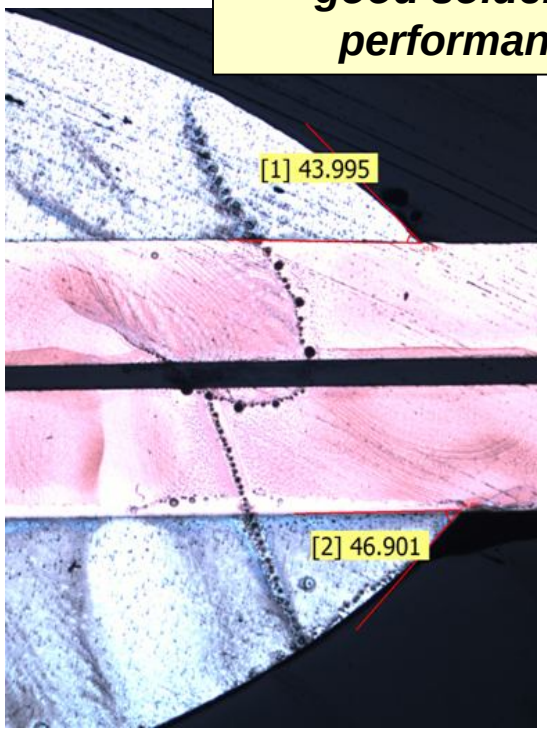
Soldering Performance – Hole Fill

- Hole Fill is strongly correlated with the wetting performance of the alloy/flux/finish combination.
- When wetting speed and force are high we should expect better hole fill -all other parameters being equal.
- Comparison of wetting balance test results are a strong indicator of hole fill capability.



Lower wetting angles are a good indicator of good soldering performance



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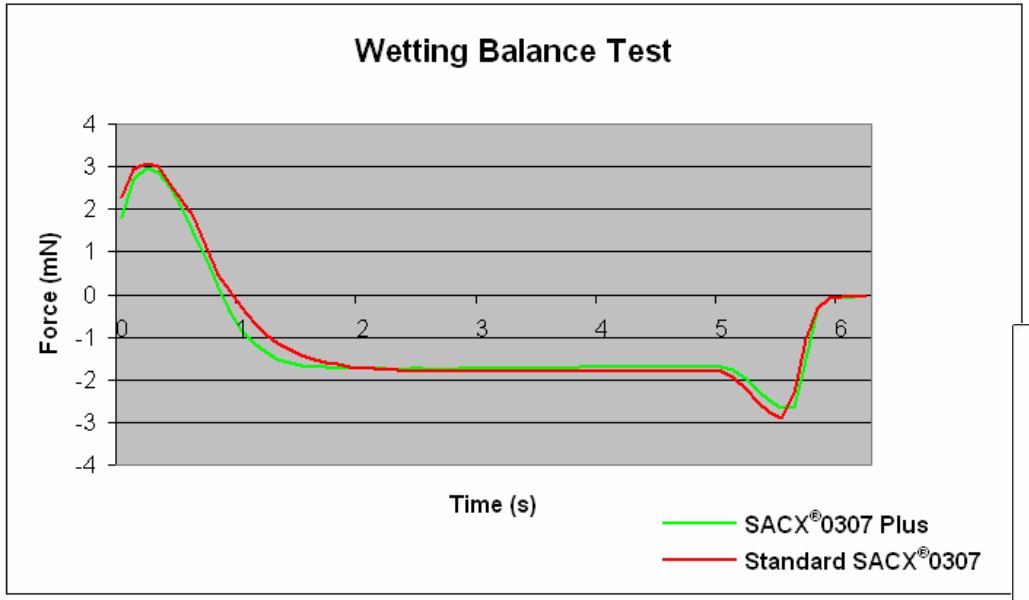
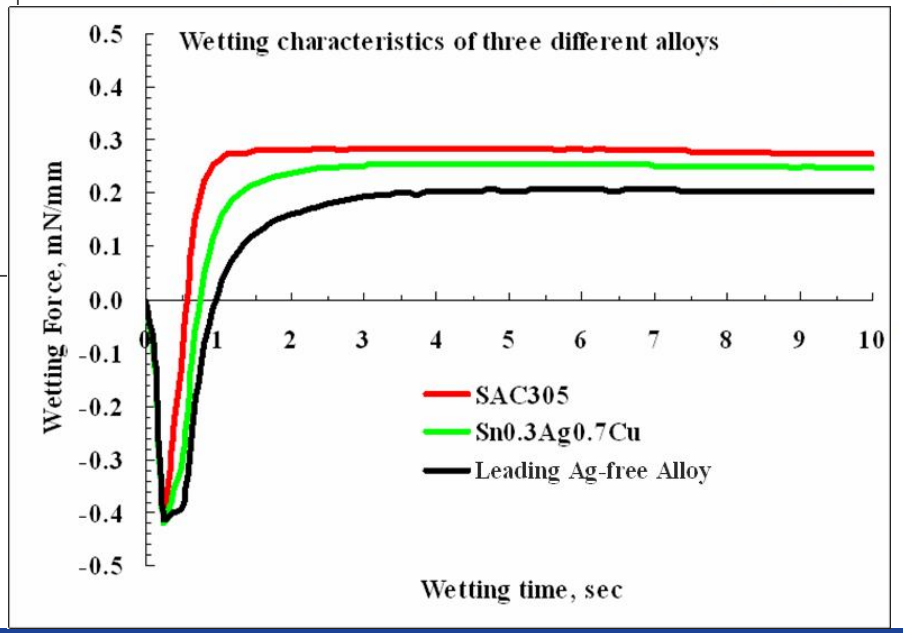
ALPHA® SACX™ Plus 0307

Soldering Performance

Hole Fill



SACX™ Plus 0307 Plus exhibits nearly identical wetting as original SACX™ Plus 0307



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ALPHA® SACX™ Plus 0307

Reliability – Thermal Fatigue Resistance

Thermal Cycling

Test Results

- SACX0307 Solder Fillet - no fatigue cracks or grain delineation

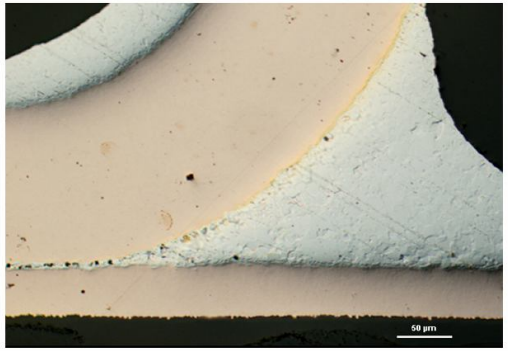
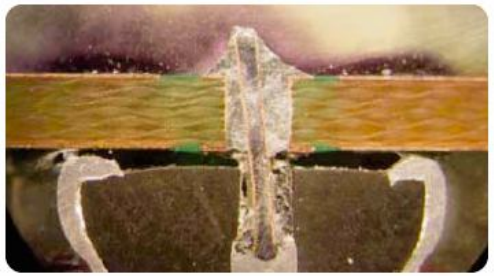
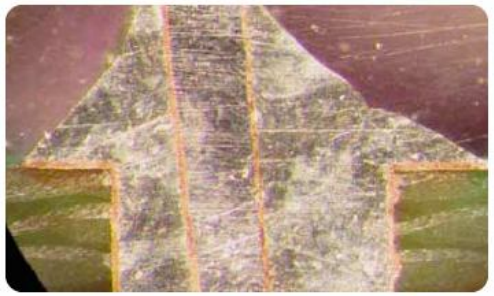


Figure B2. No fatigue cracks can be seen in the heel fillet of the joint at higher magnifications

ALPHA SACX™ Plus 0307 Plus contains many of the same constituents that make the original SACX™ Plus 0307 exhibit equivalent or better reliability than other leading Pb-free alloys





SACX after cycling – no cracks

Sampling of results from customer thermal cycling tests

Test Type	Lower	Upper	Cycles	Results
Thermal Cycling	-40	125	2000	*No difference between SACX and SAC305*
Thermal Cycling	-40	85	1000	*Lower failure rate that SAC305*
Thermal Cycling	-40	90	500	*0 failures*
Thermal Shock	-40	80	300	*Lower failures than Sn/Cu/Ni*
Thermal Cycling	0	100	500	*Passes requirements of PC manufacturer*
Thermal Cycling	-40	125	1000	*Equivalent to SAC305 better than Sn/Cu/Ni*

ALPHA® SACX™ Plus 0307

1206 Resistor Pull Tests

	Alloy Type					
	SAC305		SACX0307		Sn63/Pb37	
	Pull-off Strength (kN)	Failure Mode	Pull-off Strength (kN)	Failure Mode	Pull-off Strength (kN)	Failure Mode
	0.059	5	0.079	0	0.070	0
	0.075	5	0.071	0	0.061	0
	0.054	0	0.061	0	0.070	0
	0.075	5	0.061	0	0.081	0
	0.054	0	0.070	0	0.069	0
	0.078	5	0.093	0	0.088	0
			0.068	0	0.100	0
					0.094	0
Mean (kN)	0.066		0.072		0.079	
Std. Deviation (kN)	0.011		0.011		0.014	

0 – Unknown Failure Mode
5 – Lead failure

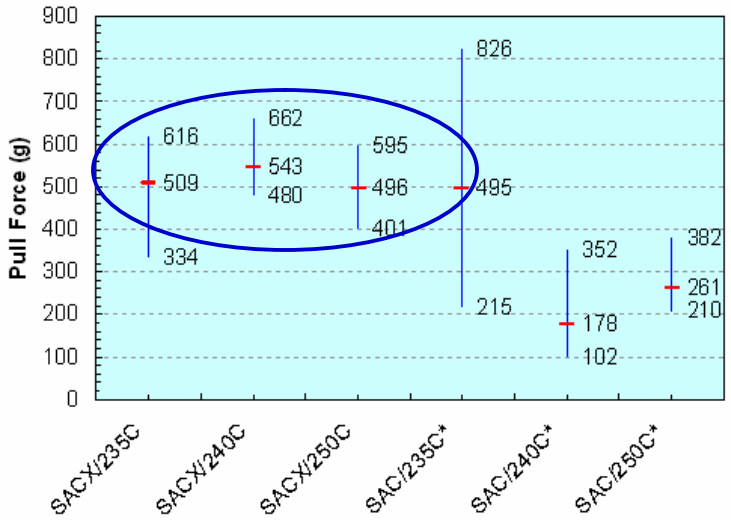
SACX™ Plus 0307 exhibits **Higher Strength** vs. SAC305 in a variety of SMT Pull Tests

Through Hole Connector Pull Tests

	Alloy Type					
	SAC305		SACX0307		Sn63/Pb37	
	Pull-off Strength (kN)	Failure Mode	Pull-off Strength (kN)	Failure Mode	Pull-off Strength (kN)	Failure Mode
	0.275	5	0.229	6	0.036	5
	0.286	5	0.329	5	0.048	5
	0.315	5	0.332	5	0.300	5
	0.265	5	0.319	5	0.214	5
	0.326	5	0.318	5	0.315	5
	0.329	5	0.332	5	0.237	5
Mean (kN)	0.299		0.310		0.192	
Std. Deviation (kN)	0.027		0.040		0.122	

Code: 5 – Lead failure, 6 – Grip failure

Sample ID	SACX/235C	SACX/240C	SACX/250C	SAC/235C	SAC/240C	SAC/250C
	594	508	480	215	352	213
	527	535	500	242	280	253
	538	565	492	221	201	342
	465	662	578	325	245	382
	334	519	495	293	264	250
	576	551	522	339	266	266
	546	576	495	576	253	250
	562	632	401	807	239	272
	522	525	447	826	113	242
	468	498	511	776	126	218
	530	538	595	651	113	237
	490	586	594	240	129	220
	573	527	468	225	136	246
	490	554	500	298	121	226
	465	516	471	659	113	210
	386	480	525	791	124	274
	500	538	438	761	102	323
	616	501	463	659	125	268
	471	488	468	274	126	221
	533	557	468	747	130	297
Avr=	509	543	496	495	178	261
High=	616	662	595	826	352	382
Low=	334	480	401	215	102	210



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ALPHA® SACX™ Plus 0307

Availability

SACX™ Plus 0307 Plus is made in each of our 3 global regions

Product Type	BAR
Product Group	BRC
Product Name	VAC

Alloy Code	Global Specification #
989	GLB-SAS-027
992	GLB-SAS-028

Item No#	Item Description	Product Name
148863	BRC 989 VAC SACX0307 Plus 1KG	ALPHA Vaculoy SACX®0307 Plus 1KG
149188	BRC 992 VAC SACX0300 Plus 1KG	ALPHA Vaculoy SACX®0300 Plus 1KG
148862	BRC 989 VAC SACX0307 Plus Chunk	ALPHA Vaculoy SACX®0307 Plus Chunk
149187	BRC 992 VAC SACX0300 Plus Chunk	ALPHA Vaculoy SACX®0300 Plus Chunk

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Consult your local / regional manufacturing plant for special shape or size requests

When to consider SACX™ Plus 0307

- For simple to standard complexity dual sided assemblies
  - ***Assembler should always consider their most difficult assembly when selecting a single alloy***

Assembly Type I	*Assembly Type II*	*Assembly Type III*	*Assembly Type IV*
Simple, single sided, FR2 / CEM-1 laminates	Dual sided FR-4 w/ PTH's, 1.6mm thick, up to 4 inner copper layers, metallized pad finishes	Complex, up to 12 inner copper layers OSP pad finishes, all processing in air	>2.4mm thick, >12 inner copper layers, large high heat capacity components

- For assemblers who want a single alloy for both wave soldering and selective / rework soldering processes
- Users of lower Ag or Ag free alloys that:
  - Are not getting the soldering performance they need
  - Are seeing an increase in mechanical reliability related field failures

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ALPHA® SACX™ Plus 0807

Summary of Properties

- Low silver content lowers alloy cost
- Engineered for use in Wave, Selective, Rework and Dip Tinning soldering applications
- Vaculoying process and unique additives minimize dross
- Fast wetting speeds and high wetting force results in excellent soldering across a wide variety of assemblies
- Silver and other additives result is strong, ductile solder joints for reliability similar or better than SAC305

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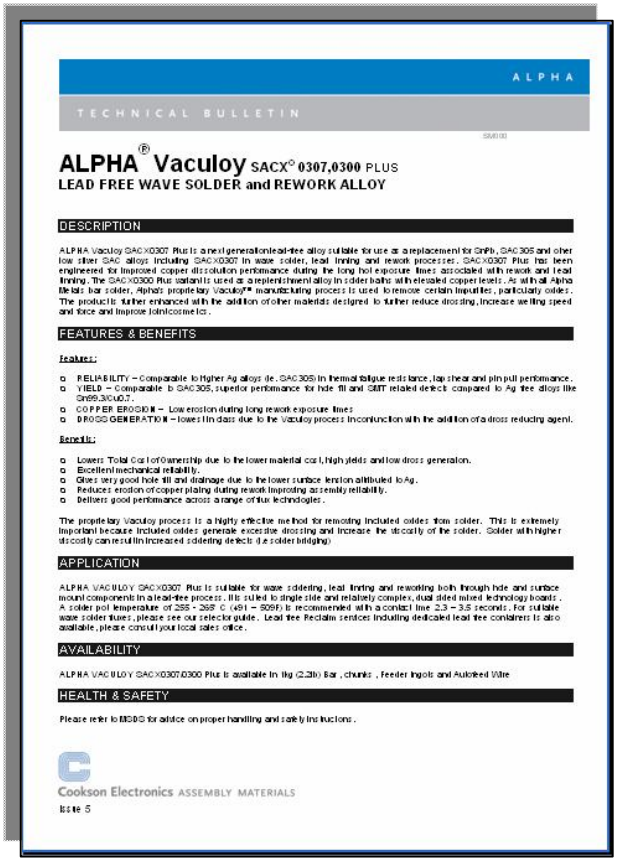
ALPHA® SACX™ Plus 0307

Technical Bulletin and MSDS



ALPHA

TECHNICAL BULLETIN

ALPHA® Vaculoy SACX® 0307,0300 PLUS
LEAD FREE WAVE SOLDER and REWORK ALLOY

DESCRIPTION

ALPHA Vaculoy SACX0307 Plus is a next generation lead-free alloy suitable for use as a replacement for SnPb, SAC305 and other low silver SAC alloys including SACX0307 in wave solder, lead tinning and rework processes. SACX0307 Plus has been engineered for improved copper dissolution performance during the long hot exposure times associated with rework and lead tinning. The SACX0300 Plus variant is used as a replenishment alloy in solder baths with elevated copper levels. As with all Alpha Metals bar solder, Alpha's proprietary Vaculoy® manufacturing process is used to remove certain impurities, particularly oxides. The product is further enhanced with the addition of other materials designed to further reduce dressing, increase wetting speed and force and improve joint cosmetics.

FEATURES & BENEFITS

Features:

- RELIABILITY – Comparable to higher Ag alloys (ie. SAC305) in thermal fatigue resistance, lap shear and pin pull performance.
- YIELD – Comparable to SAC305, superior performance for hole fill and SMT related defects compared to Ag free alloys like Sn99.3Cu0.7.
- COPPER EROSION – Low erosion during long rework exposure times
- DROSS GENERATION – lowest tin dross due to the Vaculoy process in conjunction with the addition of a dross reducing agent.

Benefits:

- Lowers Total Cost of Ownership due to the lower material cost, high yields and low dross generation.
- Excellent mechanical reliability.
- Gives very good hole fill and drainage due to the lower surface tension attributed to Ag.
- Reduces erosion of copper plating during rework improving assembly reliability.
- Delivers good performance across a range of flux technologies.

The proprietary Vaculoy process is a highly effective method for removing included oxides from solder. This is extremely important because included oxides generate excessive drossing and increase the viscosity of the solder. Solder with higher viscosity can result in increased soldering defects (ie solder bridging)

APPLICATION

ALPHA VACULOY SACX0307 Plus is suitable for wave soldering, lead tinning and reworking both through hole and surface mount components in a lead-free process. It is suited to single side and relatively complex, dual sided mixed technology boards. A solder pot temperature of 255 - 265° C (491 – 509F) is recommended with a contact time 2.3 – 3.5 seconds. For suitable wave solder fluxes, please see our resin guide. Lead free Reclaim services including dedicated lead free containers is also available, please consult your local sales office.

AVAILABILITY

ALPHA VACULOY SACX0307-0300 Plus is available in 1kg (2.2lb) Bar, chunks, Feeder Ingots and Autofeed Wire

HEALTH & SAFETY

Please refer to MSDS for advice on proper handling and safety instructions.

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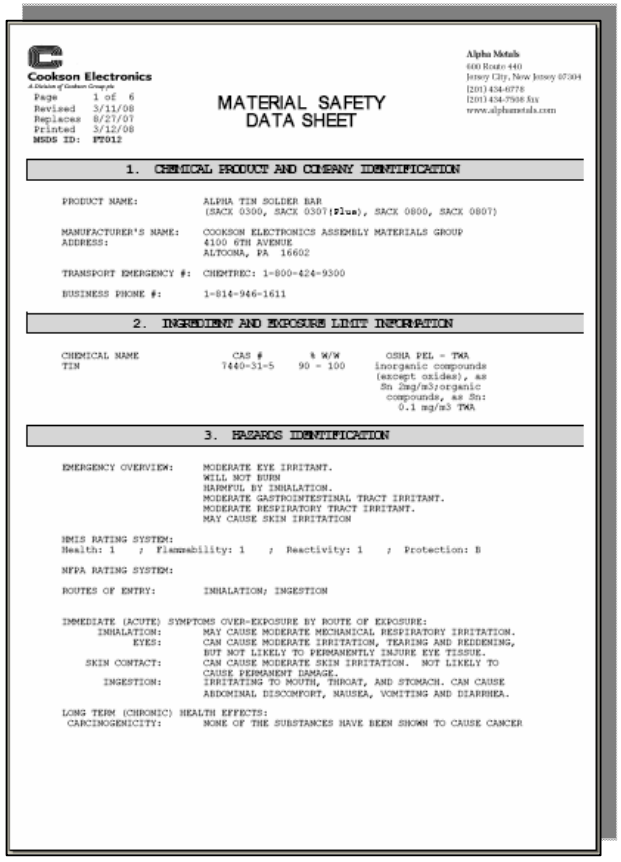
Issue 5



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Page 1 of 6
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Printed 3/12/08
MSDS ID: PT012

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(201) 434-7568 fax
www.alphametals.com

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: ALPHA TIN SOLDER BAR (SACX 0300, SACX 0307(Plus), SACX 0800, SACX 0807)

MANUFACTURER'S NAME: COOKSON ELECTRONICS ASSEMBLY MATERIALS GROUP
ADDRESS: 4100 6TH AVENUE ALTOONA, PA 16602

TRANSPORT EMERGENCY #: CHEMTREC: 1-800-424-9300

BUSINESS PHONE #: 1-814-946-1611

2. INGREDIENT AND EXPOSURE LIMIT INFORMATION

CHEMICAL NAME	CAS #	% W/W	OSHA PEL - TWA
TIN	7440-31-5	90 - 100	Inorganic compounds (except oxides), as Sn 2mg/m3;organic compounds, as Sn: 0.1 mg/m3 TWA

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: MODERATE EYE IRRITANT.
WILL NOT BURN
HARMFUL BY INHALATION.
MODERATE GASTROINTESTINAL TRACT IRRITANT.
MODERATE RESPIRATORY TRACT IRRITANT.
MAY CAUSE SKIN IRRITATION

HMIS RATING SYSTEM:
Health: 1 ; Flammability: 1 ; Reactivity: 1 ; Protection: B

NFPA RATING SYSTEM:

ROUTES OF ENTRY: INHALATION; INGESTION

IMMEDIATE (ACUTE) SYMPTOMS OVER-EXPOSURE BY ROUTE OF EXPOSURE:
INHALATION: MAY CAUSE MODERATE MECHANICAL RESPIRATORY IRRITATION.
EYES: CAN CAUSE MODERATE IRRITATION, TEARING AND REDDENING, BUT NOT LIKELY TO PERMANENTLY INJURE EYE TISSUE.
SKIN CONTACT: CAN CAUSE MODERATE SKIN IRRITATION. NOT LIKELY TO CAUSE PERMANENT DAMAGE.
INGESTION: IRRITATING TO MOUTH, THROAT, AND STOMACH. CAN CAUSE ABDOMINAL DISCOMFORT, NAUSEA, VOMITING AND DIARRHEA.

LONG TERM (CHRONIC) HEALTH EFFECTS:
CARCINOGENICITY: NONE OF THE SUBSTANCES HAVE BEEN SHOWN TO CAUSE CANCER

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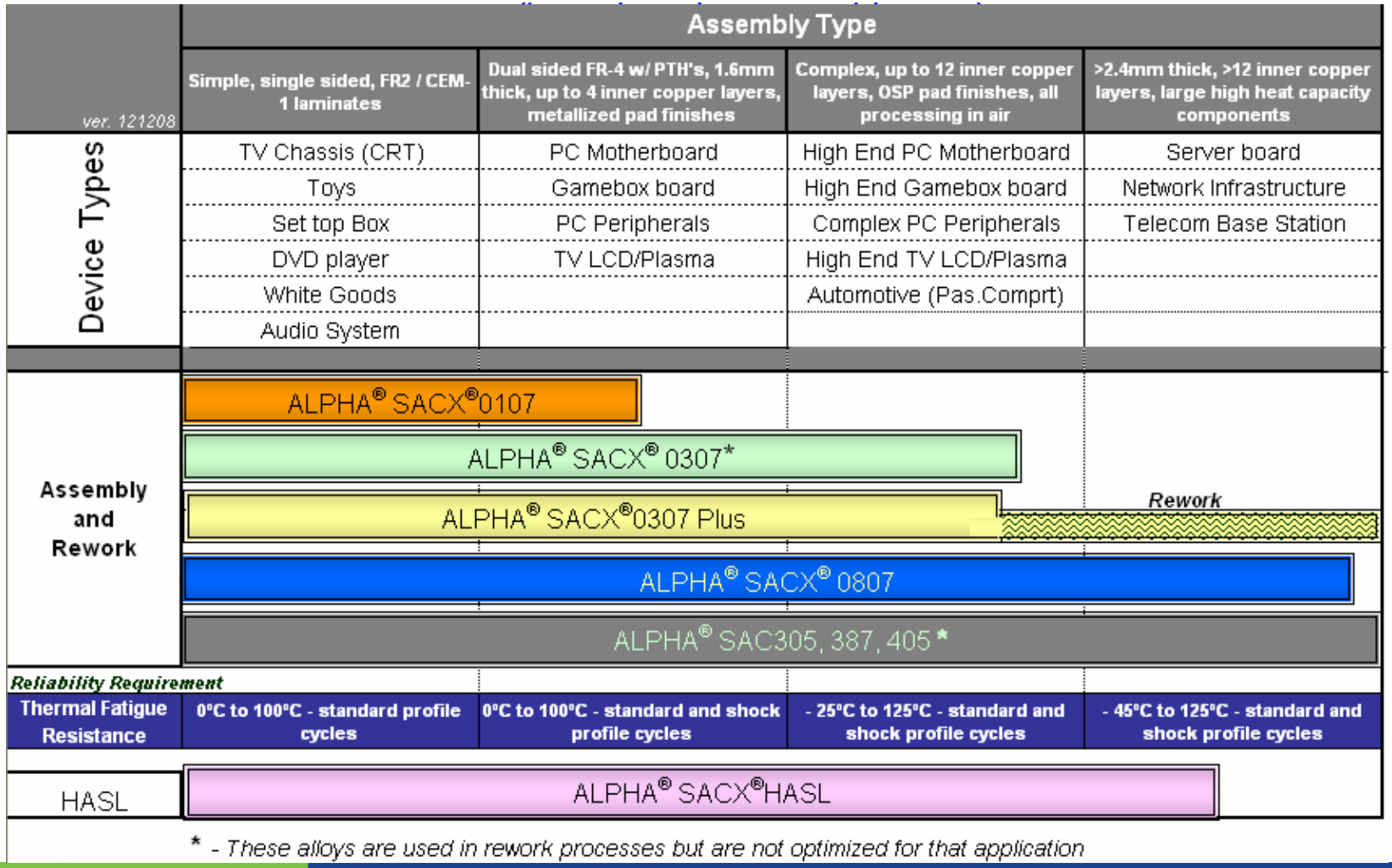
Documents available from www.alpha.cooksonelectronics.com or contact your local Alpha® sales office

ALPHA® SACX™ Plus 0307

Use the "SACX™ Plus Family" map for guidance on which alloy to offer



* - *These alloys are used in rework processes but are not optimized for that application*

ALPHA® SACX™ Plus 0307

Relative Comparision of SACX Alloy Performance Attributes