2009 Poster Session 2

ARCHIVE 2009

Elastomer Contact System for ATE – Innovation to the "Core"
Tony Smith, Frank Bumb, Jack Pereschuk—Phoenix Test Arrays
Ila Pal, Roni Awale—Antares Advanced Test Technologies

The Development of a PB Free Test Socket
Hidekazu "Hide" Miura, Fred Megna—MJC Electronics Corporation

Kelvin Contacting
Jim Brandes, Valts Treibergs—Everett Charles Technologies

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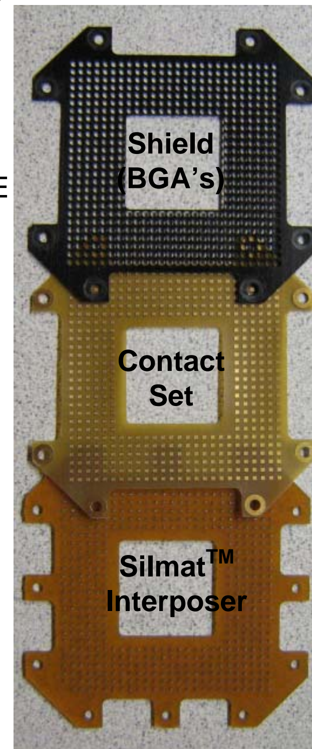
Elastomer Contact System for ATE
Innovation to the "Core"

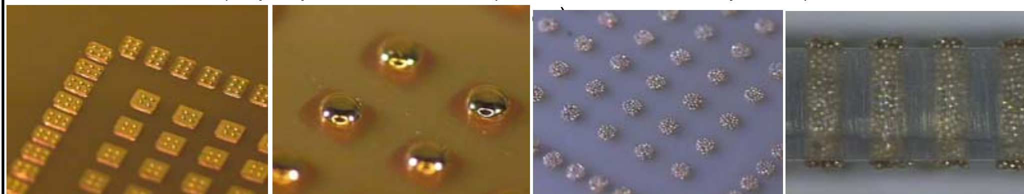
Phoenix Test Arrays
Tony Smith, Frank Bumb, Jack Pereschuk

Antares ATT
Roni Awale, Ila Pal

- **Industry Challenges**
  - Apps: RF/High Frequency, High Speed/Power
  - Pkg: Small, Dense, Fine Pitch, Lead-free
  - Test: Transparency, Life, Yield, Temp, Cost
- **Innovative PTA Elastomer Interconnect**
  - Low Profile Elastomer Contact System with "Core" for High Performance Hand Test & ATE
  - Designed to Address Unmet Customer Needs
  - Validated Electrical & Mechanical Advantages
  - Low Cost of Ownership in ATE
- **Contact Set**
  - Reliable Oxide Penetration, Z-axis Only
  - Uniform Sharp Tips on Each Contact
  - Pierces Leads With No Damage or Transfer
  - Flexible Carrier Protects Silmat™
  - Durable & Easy to Clean
- **Silmat™ Elastomer Interposer**
  - Extremely Resilient & Compliant with Good Operating Range for ATE Production
  - No Damage to Load Boards
  - Single Unit Easy to Install & Replace
  - Long Life with Patented "Core" Technology
  - Various Product Options (Thickness, Structure)



Contact Set (Top/Tips – Bottom/Tails) Silmat™ Interposer (Matrix – Cross

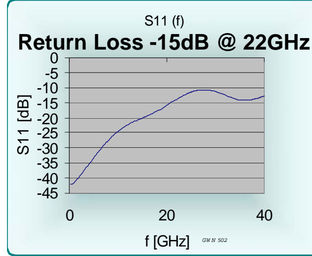


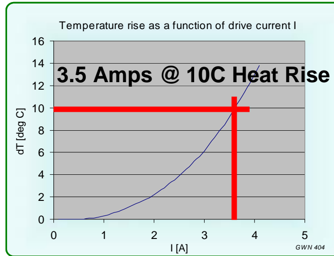
3/2009 Elastomer Contact System for ATE - Innovation to the "Core" 1

Poster #1

PTA & AATT Collaborative Qualification Process with Validation Test Data

Electrical Data (AC-DC):

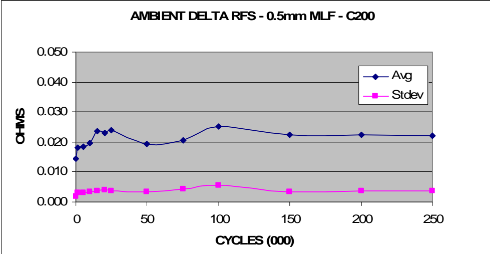


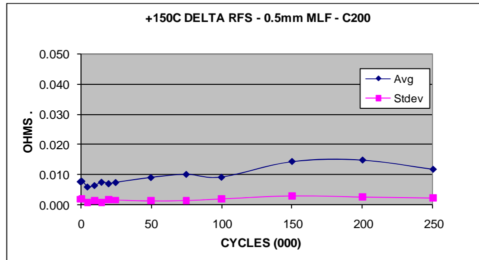


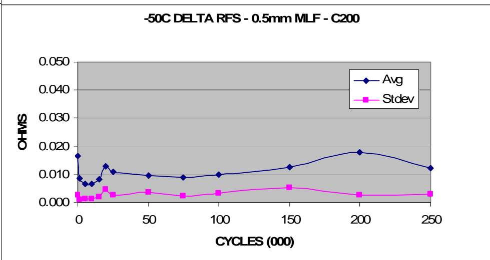
Low Profile Contact Structure & Materials Enable High Bandwidth & High Current Applications

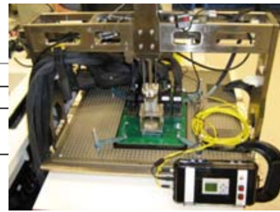
Mechanical Data:

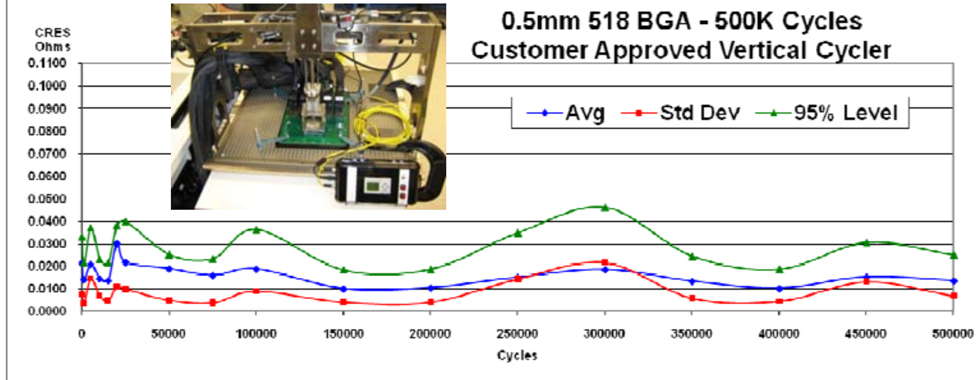
0.5mm 44 QFN
250K Cycles
Tri-Temp
RFS Handler









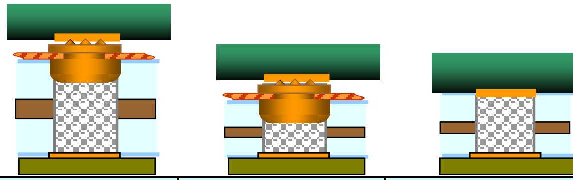


Mechanical Cycling Results Under Various Conditions Indicate Excellent Contact Reliability & Long Life

3/2009 Elastomer Contact System for ATE - Innovation to the "Core" 2

Poster #1

Product Summary & Specifications



C Series High Performance Contacts for Hand Test & Automation		C200 Core Full Height	C300 Core Half Height	C400 Core Half Height
Contact Structure		Contact Set & Silmat™ (plus Shield for BGA)	Contact Set & Silmat™ (plus Shield for BGA)	Silmat™ Only (plus Shield for BGA)
Packages (BGA, LGA, QFN, etc)		All Package Types & Sizes, Full Array Capabilities		
Pitches		Released Pitches Down to 0.4mm		
Electrical Performance	Contact Length	1.04mm	0.63mm	0.45mm
	Bandwidth	40 Ghz	> 40 Ghz	> 40 Ghz
	Inductance	0.33 nH	< 0.20 nH	< 0.20 nH
	Contact Resistance	< 50 mOhms	< 50 mOhms	< 50 mOhms
	Current Capacity	3.5A @ 10C Rise	3.5A @ 10C Rise	3.5A @ 10C Rise
	Component Proximity	Within 0.75mm	Within 0.75mm	Within 0.75mm
Compliance		**Up to 0.46mm**	**Up to 0.28mm**	**Up to 0.25mm**
Contact Set Operating Life		> 2,000,000	> 2,000,000	n/a
Silmat™ Interposer Operating Life		> 500,000	> 500,000	> 10,000
Value Summary: High Performance with Durability & Compliance for ATE -- Low COO		Most Compliance Longest Life ATE Optimized	Best Electrical Performance for RF ATE Optimized	Best Electrical Performance for RF Hand Test/Eval/B2B
Target Markets		Logic/High Freq/Pwr HT/SLT/ATE HVM	RF/Microwave HT/SLT/ATE HVM	RF/Low Cost HT High Perf Interposer

Conclusions

- **PTA & AATT Collaborative Qualification Testing Methods Effectively Simulated ATE Prod & Validated Specifications**
  - Demonstrated Consistent & Repeatable Performance
- **Elastomer Contact System with "Core" is an Innovative, Protected, Released Product with Sufficient Capacity to Meet Existing and Emerging Customer Needs**
  - Addresses Unmet Customer Needs in the Lab & ATE Production
- **Differentiated Solution with Compelling Value Proposition**
  - ***High Performance*** **–** both electrical & mechanical
  - ***Good Compliance*** **–** more stroke & operating range than other low profile options, enables reliable ATE testing
  - ***Long Life*** **–** patented "Core", resilient materials, robust mechanics, protected contacts, less cleaning, no damage

= Electrically Transparent Solution for Lab & Eval Testing
= Low Cost of Ownership Solution for ATE Testing

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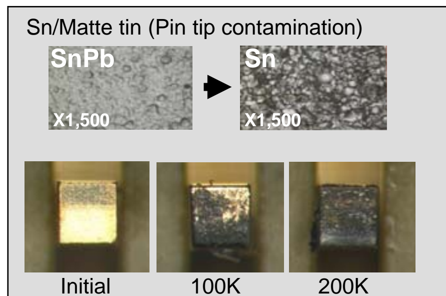
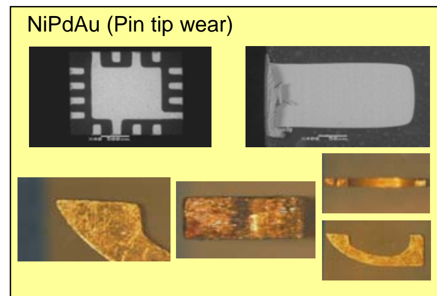
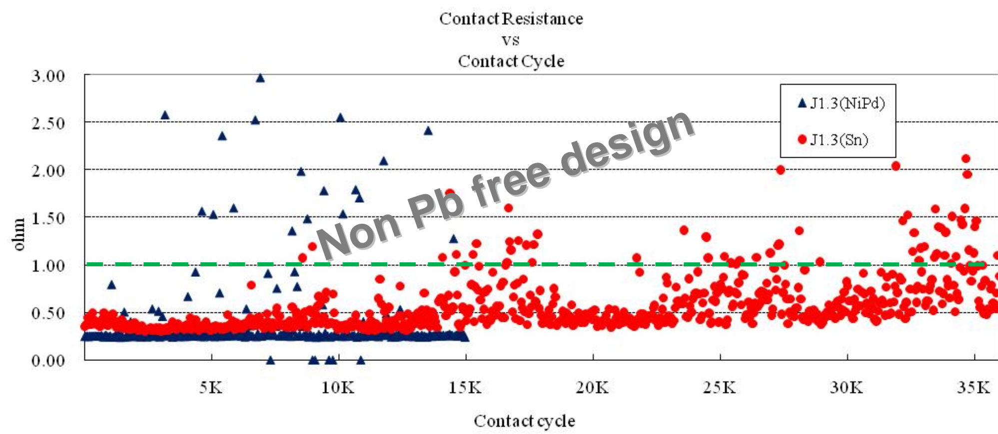
The Development of a PB Free Test Socket

Hidekazu “Hide” Miura, Fred Megna
MJC Electronics Corp.







RoHS is the name given to the European Union's directive 2002/95 which went into effect in 2006. It deals with the reduction of hazardous substances in electronic equipment and components. The RoHS directive currently lists 6 materials as being restricted; lead is one of those substances.

The lead contained in the solder of the device’s terminal finish has been reduced or eliminated from many of the devices that are manufactured today. Being a soft metal it allows for intimate, low resistance contact between the socket contact element and the terminal of the device under test. It also provides lubrication for the wiping or scrub action of the socket’s contactor. The reduction in lead and its lubrication required changes in the shape and wiping action of the socket contactor element in order to overcome these issues.

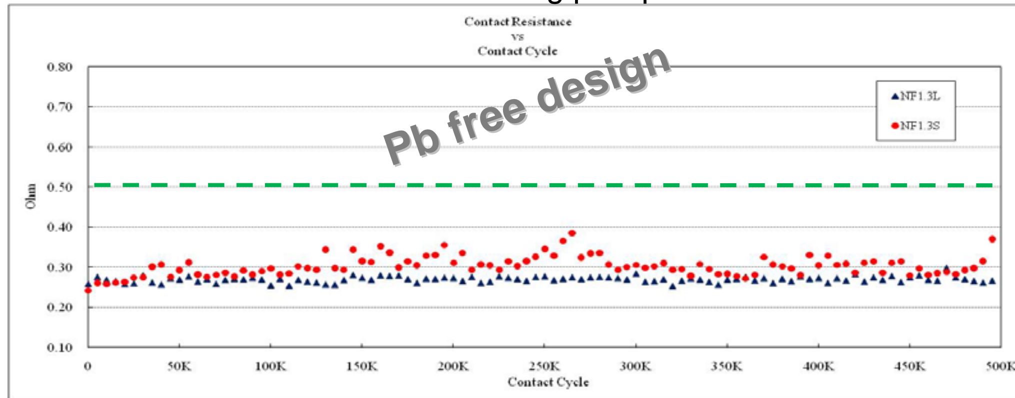
3/2009 The Development of a PB Free Test Socket 1

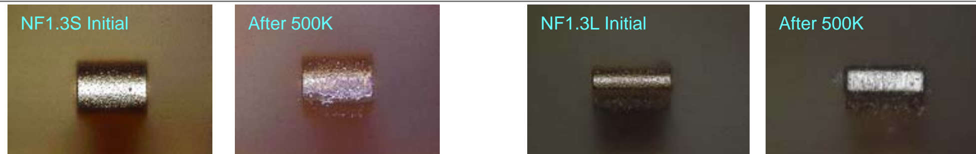
Poster #2

The Development of a PB Free Test Socket

Pb-Free solution

Self cleaning pin tip





Element type (Pin name)	NF0.5BL-L (NiPdAu)	NF0.5BL-S (Sn / Matte)	NF0.8 (Sn / Matte)	NF1.3L (NiPdAu)	NF1.3S (Sn / Matte)	NF1.3L Kelvin	NF1.3S Kelvin
Pad material	NiPdAu	Sn/Matte tin	Sn/Matte tin	NiPdAu	Sn/Matte tin	NiPdAu	Sn/Matte tin
Path length *1	0.94mm	0.95mm	1.94mm	2.17mm	1.76mm	2.17mm	1.76mm
S11 *2	19.1GHz	19.4GHz	8.4GHz	11.7GHz	12.6GHz	6.06 GHz	8.12GHz
S21 *3	25.2GHz	25.2GHz	18.4GHz	20.2GHz	21.2GHz	14.35GHz	21.21GHz
Inductance *4	0.256nH	0.48nH	0.7nH	0.583nH	0.435nH	0.583nH	0.435nH
Capacitance *5	0.106pF	0.09pF	0.21pF	0.253pF	0.2pF	0.253pF	0.2pF
Resistance *6	<0.03ohm	<0.03ohm	<0.03ohm	<0.03ohm	<0.03ohm	<0.03ohm	<0.03ohm
Contact force	15 g	15g/25g	30g	20g	35g	20g	35g
Min pitch	0.3mm	0.3mm	0.4mm	0.4mm	0.4mm	0.5mm	0.5mm
Current *7	2.5A	3A	3A	2.5A	3A	2.5A	3A
Over travel	0.15mm	0.1/0.15mm	0.2mm	0.3mm	0.2mm	0.2mm	0.2mm
Environmental	Ambient	Ambient	Ambient	Ambient-125	-40C-125C	Ambient-125C	-40C-125C
Element life *8	100K	>100K	>100K	500K	>400K	>200K	>200K
Elastomer life *9	100K	100K	100K	500K	400K	200K	200K

Field data from HVM Sites showed that the non-Pb free pin design had increased wear and maintenance frequency (~5000 cycles).

Reviewing the field returns, it was determined that they could be broadly grouped into (2) categories;

1) Contamination; heavy deposits of the device lead terminal finish (matte tin) on the contact element.
2) Increased wear; a flattening of the contact element due to the hardness of the NiPdAu

Using the original contact element shape, harder materials were tried (Tungsten and Cobalt). While the harder materials did offer reduced wear, they could not provide a consistent, low resistance contact.

Poster #2

The Development of a PB Free Test Socket

HVM customer Data

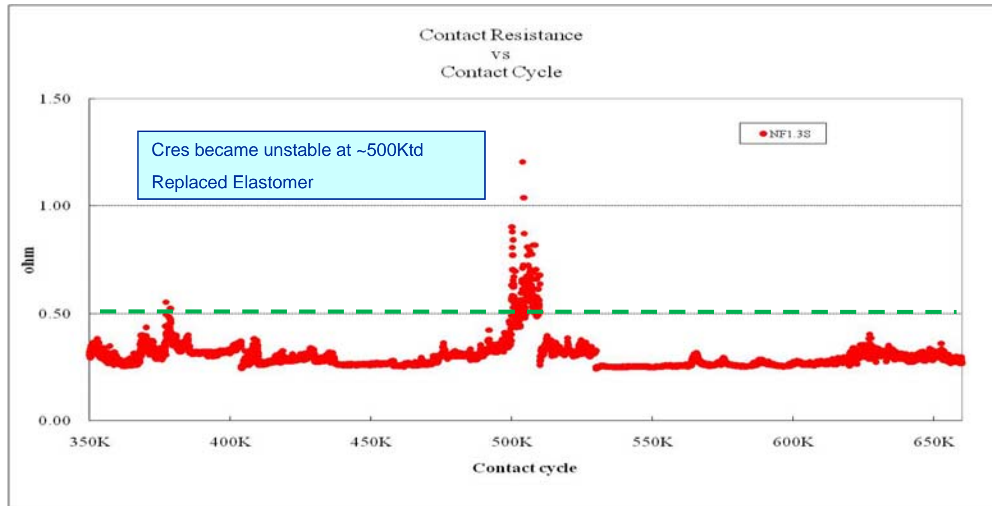
Self cleaning pin tip

Both of the above categories would be addressed by changing the shape and wiping action of the contact element.

The S series (matte tin) was redesigned with a larger radius and a larger wiping action of the contact element. This provides for a self cleaning action.

The L series (NiPdAu) was redesigned with a smaller radius and smaller wiping action of the contact element. This provides for improved wear performance.

Field data shows lower, more consistent contact resistance, increased yield and longer maintenance frequency (500Ktd's).



Company A

Using NF1.3S (Kelvin) w/MT9928

Cleaning Frequency: per 5days

Company B

Using NF0.5-S

used the socket up to 600K and they reported that the result was good.

Company C

Using NF1.3L-Kelvin

170K w/o any problem or maintenance

Company D

Used NF1.3S Kelvin socket up to 980K w/ some maintenance.

(Maintenance detail is not clear)

Company E

Used NF1.3L socket up to 800K (w/ some maintenance)

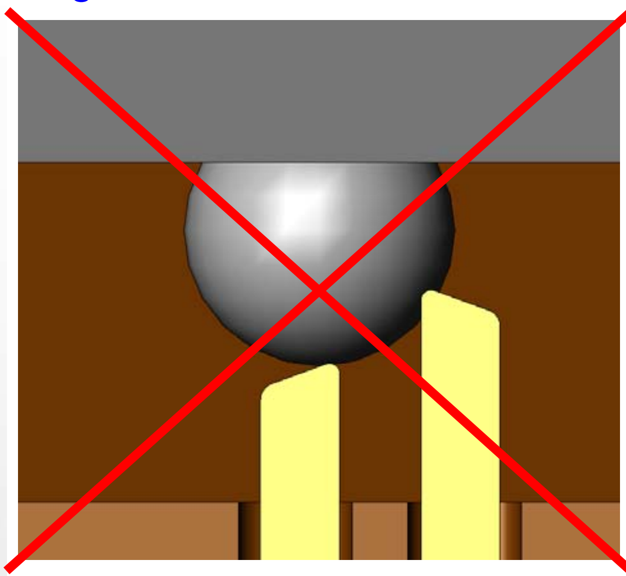
(Maintenance detail is not clear)

Kelvin Contacting

Jim Brandes, Product Manager   Valts Treibergs, Manager of Research and Development
Everett Charles Technologies

Challenge: Contacting BGAs

- More BGAs require Kelvin
  - Power management on chip, e.g.
- Present challenges for Kelvin contact



- Dual probes occupy more space
- Probes not concentric to ball
- Limits fine-pitch Kelvin capability

Accuracy is Critical

- Landing on apex negatively affects solderability
- Landing probe too close to edge can cause ball shear

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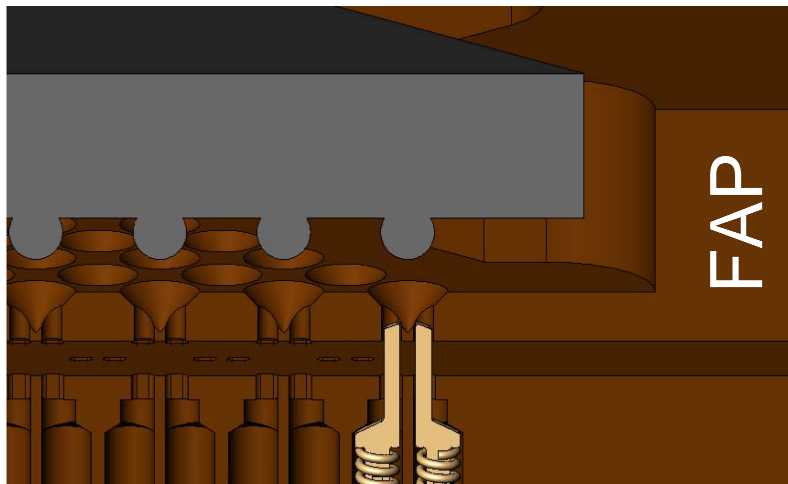
EVERETT CHARLES TECHNOLOGIES

3/2009   Kelvin Contacting   1

Kelvin Contacting

Solution: BGA Floating Alignment Plate (FAP)



- Provides the most accurate alignment – directly to balls
  - Ensures that both probes will land on target
  - Ensures that probes will avoid ball apex and edges
- Protects probe tips
- FAP-capable probes support:
  - Full arrays at 0.65 mm pitch
  - Partial arrays at 0.5 mm pitch
  - Peripheral solder balls at 0.4 mm pitch

DUT-side tips 0.1 mm

Board-side tips 0.4 mm

Gemini Kelvin for BGA - Working height 3.42 mm

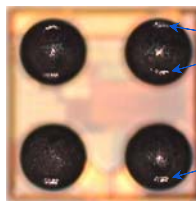
Poster #3

Kelvin Contacting

New, Finer-Pitch Kelvin Probe in Development

Ideal for Wafer-Scale Test

0.4 mm pitch BGA with Kelvin probe marks on two of four solder balls



Two witness marks

One witness mark

- Capable of landing two probes on full arrays down to 0.4 mm pitch
- Capable of landing two probes in-line (QFN, QFP, SO) down to 0.3 mm pitch
- Capable of being used with a Floating Alignment Plate
    - FAP not usually used for wafer-scale test – optical alignment sufficient
    - Useful for contacting singulated packages

DUT-side tips 0.05 mm

Board-side tips 0.28 mm

Gemini Kelvin for BGA / WST - Working height 2.76 mm

Kelvin Contacting

Poster #3