



Burn-in & Test Socket Workshop

March 6-9, 2005
Hilton Phoenix East / Mesa Hotel
Mesa, Arizona

ARCHIVE

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**Burn-in & Test
Socket Workshop**

Technical Program

Session 2

Monday 3/07/05 10:30AM

SOCKET DESIGN ADVANCEMENTS

“Development Of A Production Worthy Kelvin Contact Test Socket”

Fred Megna – Micronics Japan Co., LTD Valen Burd – Microchip Corporation

“Topless Burn-in Socket – A Customer’s Socket Standardization”

(follow-up to the keynote speaker 2004)

Holger Hoppe – Infineon Technologies AG

“The Case For A Universal Socket Footprint”

John Mendes – IBM Microelectronics

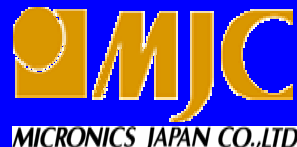
Development of a Production Worthy Kelvin Contact Test Socket

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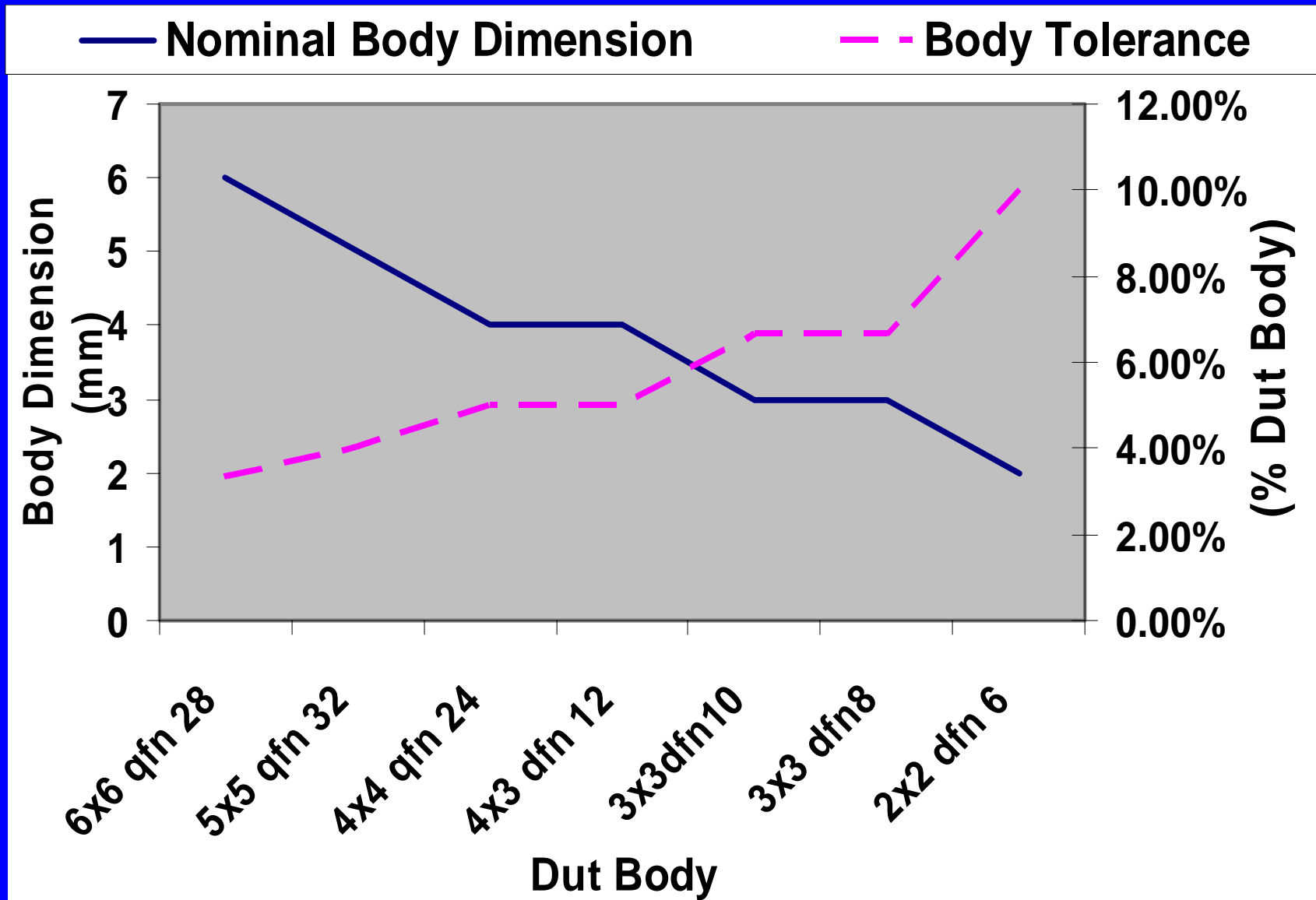
Valen Burd
Microchip Corporation
2355 W. Chandler Blvd
Chandler, AZ 85224



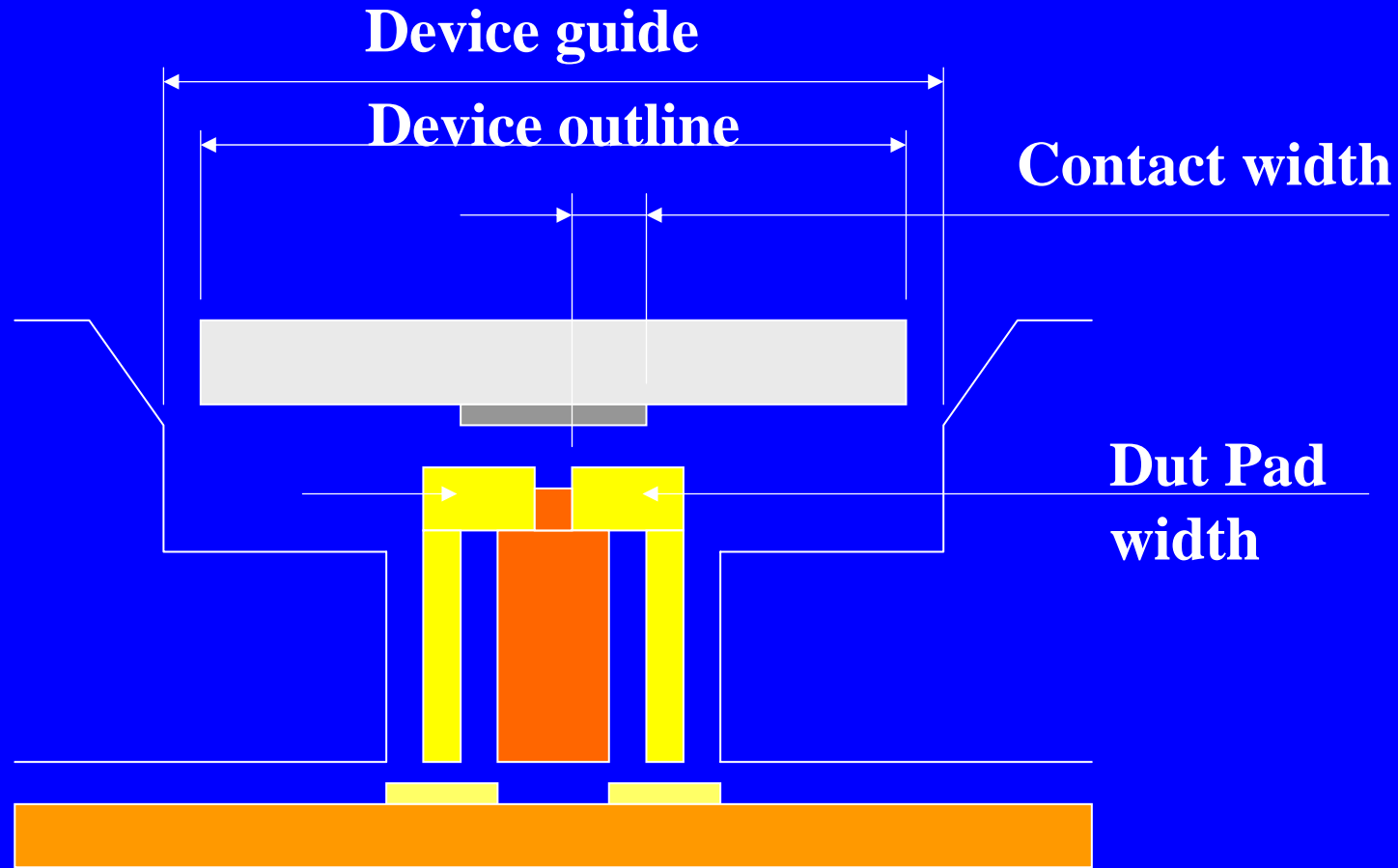
Fred Megna
Micronics Japan Co. LTD (Phoenix office)
1201 S. Alma School Rd.
Suite 7550
Mesa, AZ 85210



Static Device Tolerance



Existing J-Element

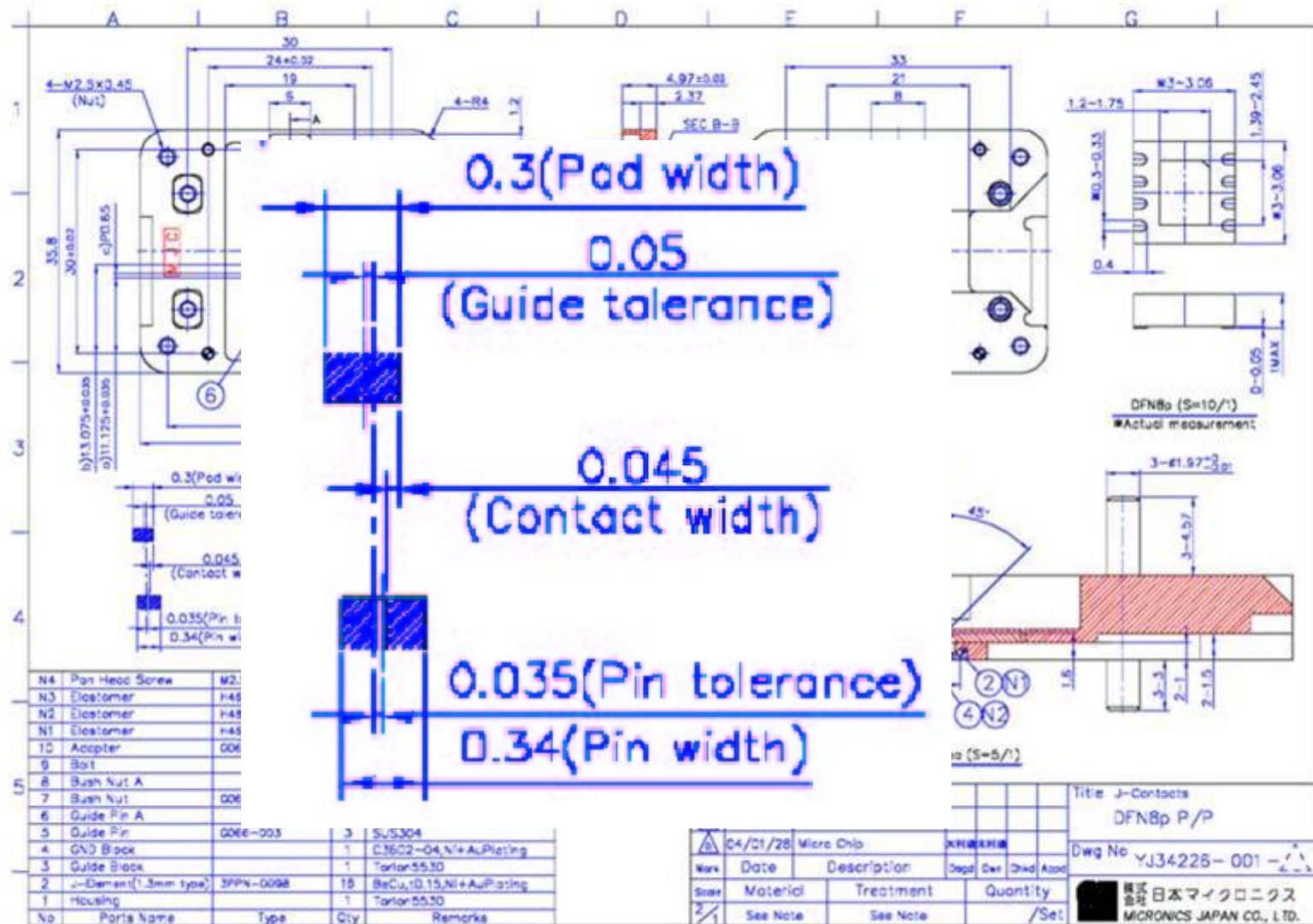


- Sense/Force j-elements are located side by side.
- TWCC is limited by dut pad width and device outline tolerance.

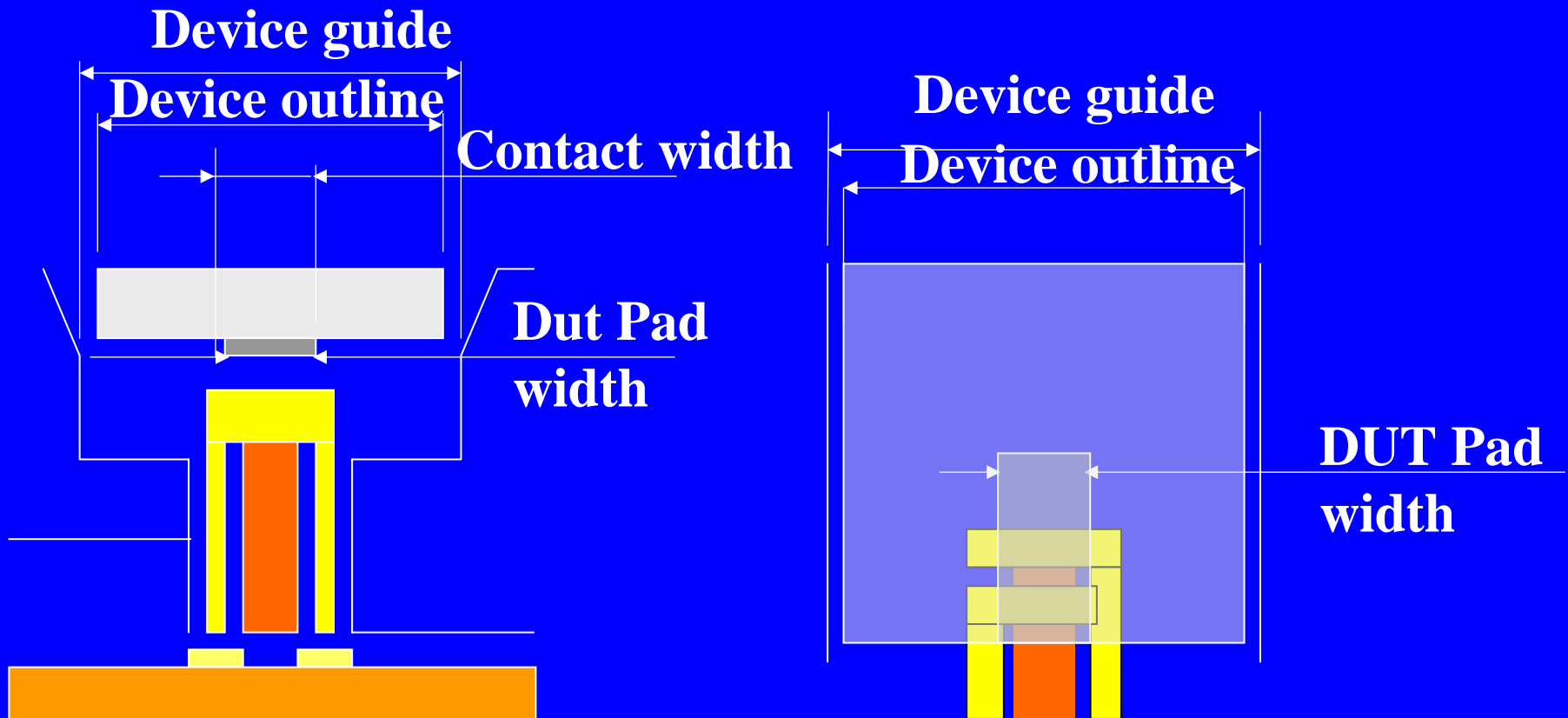
TWCC

Specification		CASE-A	CASE-B	CASE-C
PKG	Minimum pad width (mm)	0.35	0.3	0.25
	PKG outline tolerance (+/- mm)	0.02	0.02	0.02
	Pad location tolerance (+/- mm)	0.02	0.02	0.02
Socket	Socket guide clearance (mm)	0.05	0.05	0.05
	Socket guide tolerance (mm)	0.04	0.04	0.04
	J-Element location tolerance (+/- mm)	0.035	0.035	0.035
	Maximum isolation film width (mm)	0.065	0.065	0.065
Minimum contact width (mm) (TWCC)		0.033	0.007	-0.018

Existing Design



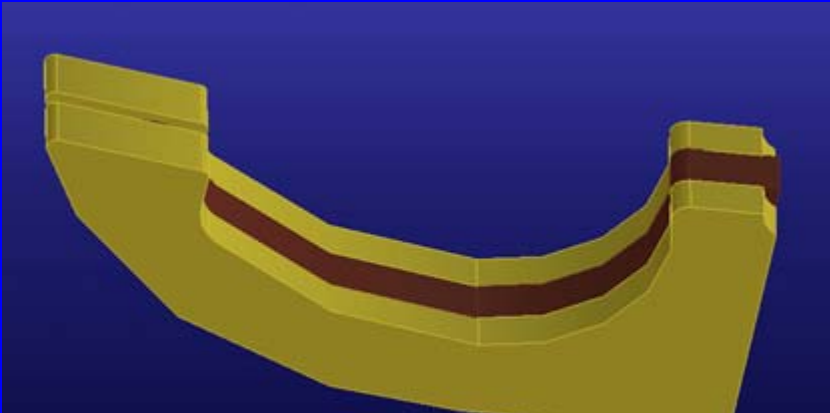
New: Kelvin B-Type J-Element



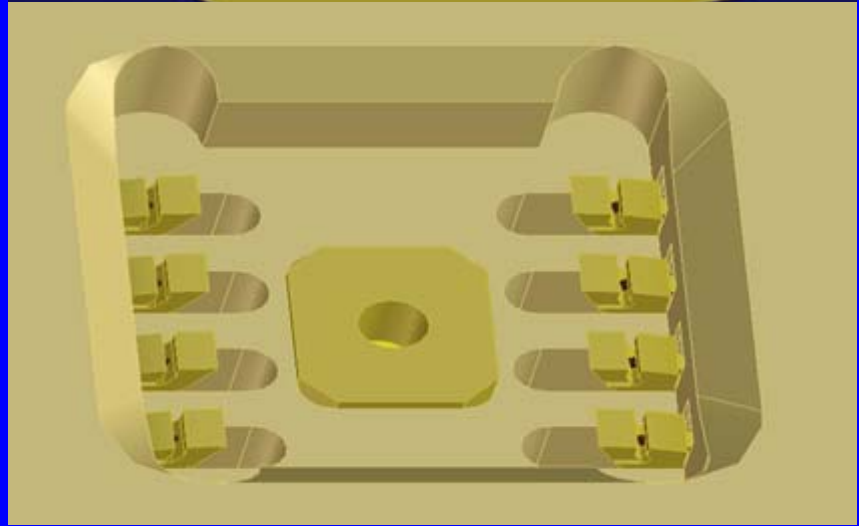
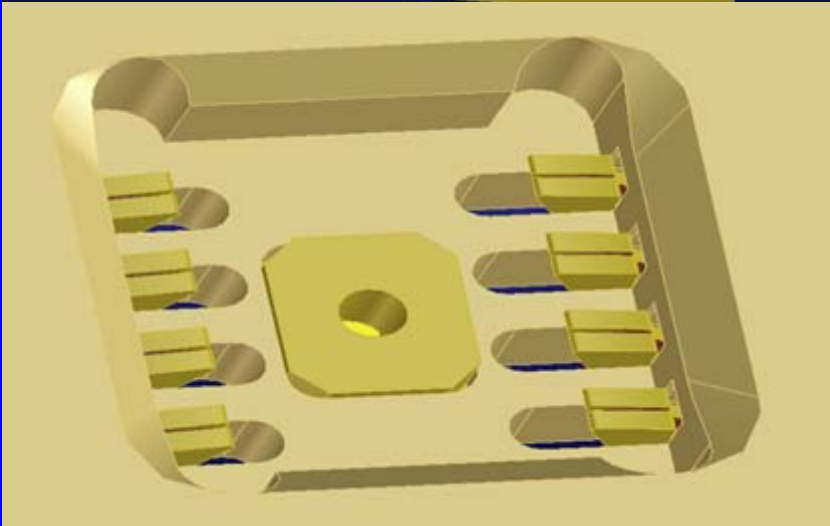
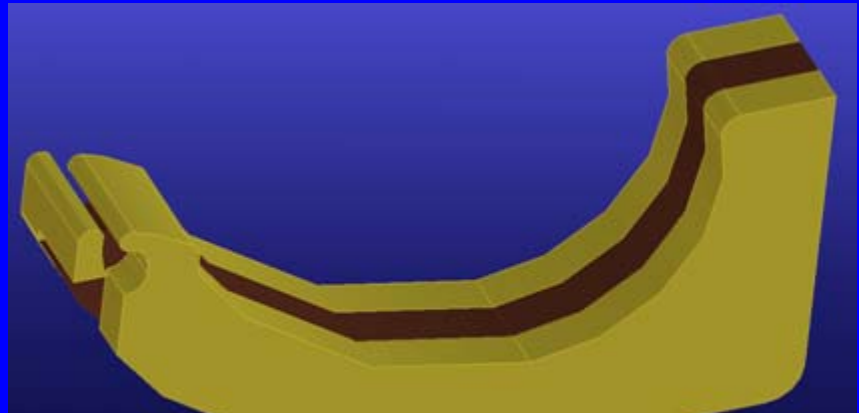
- Sense/Force j-elements are located front to back.
- TWCC is limited by dut pad length which is typically 1.5x width.

J-Element

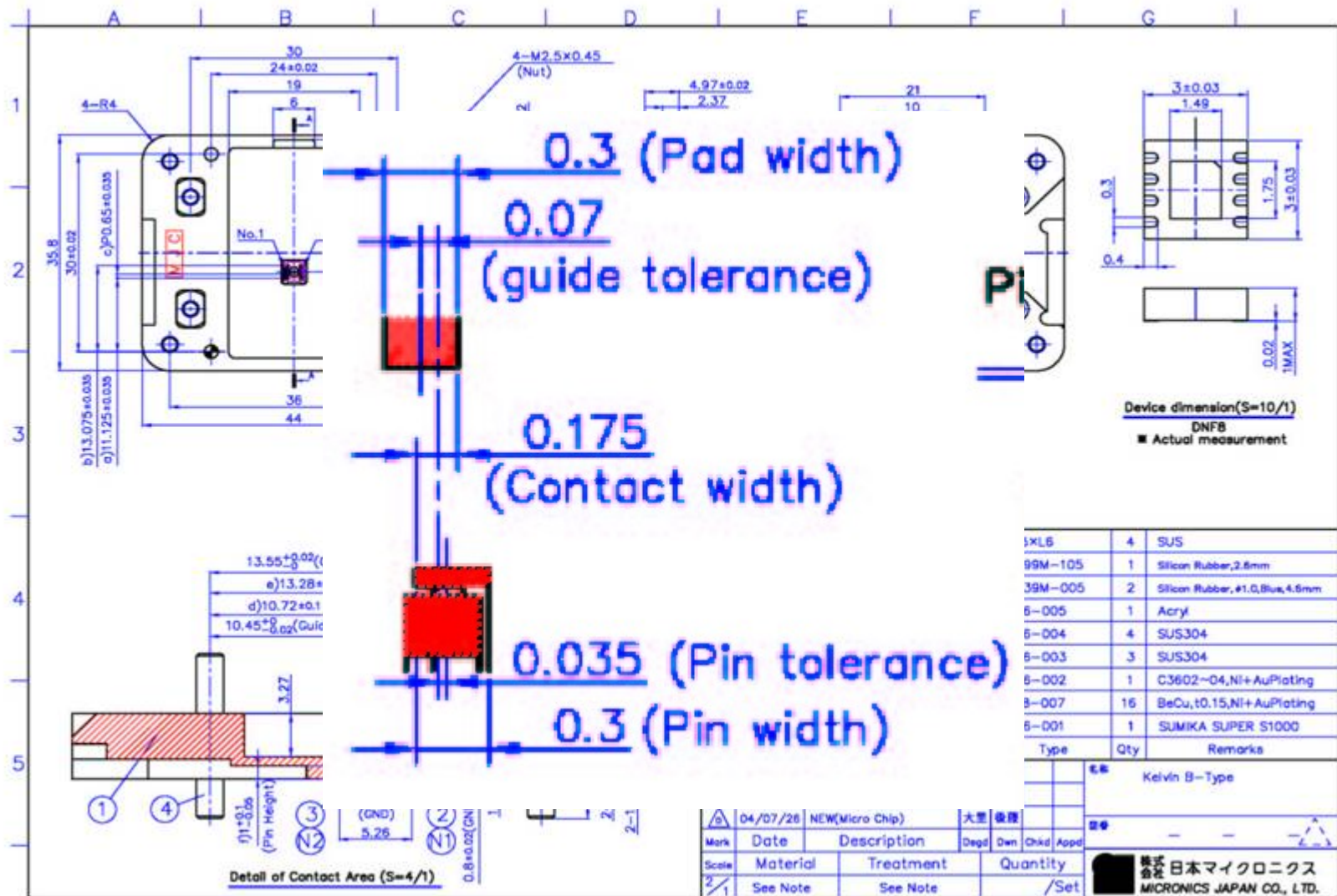
Existing J-Kelvin



New: Kelvin B-Type



Kelvin B Design



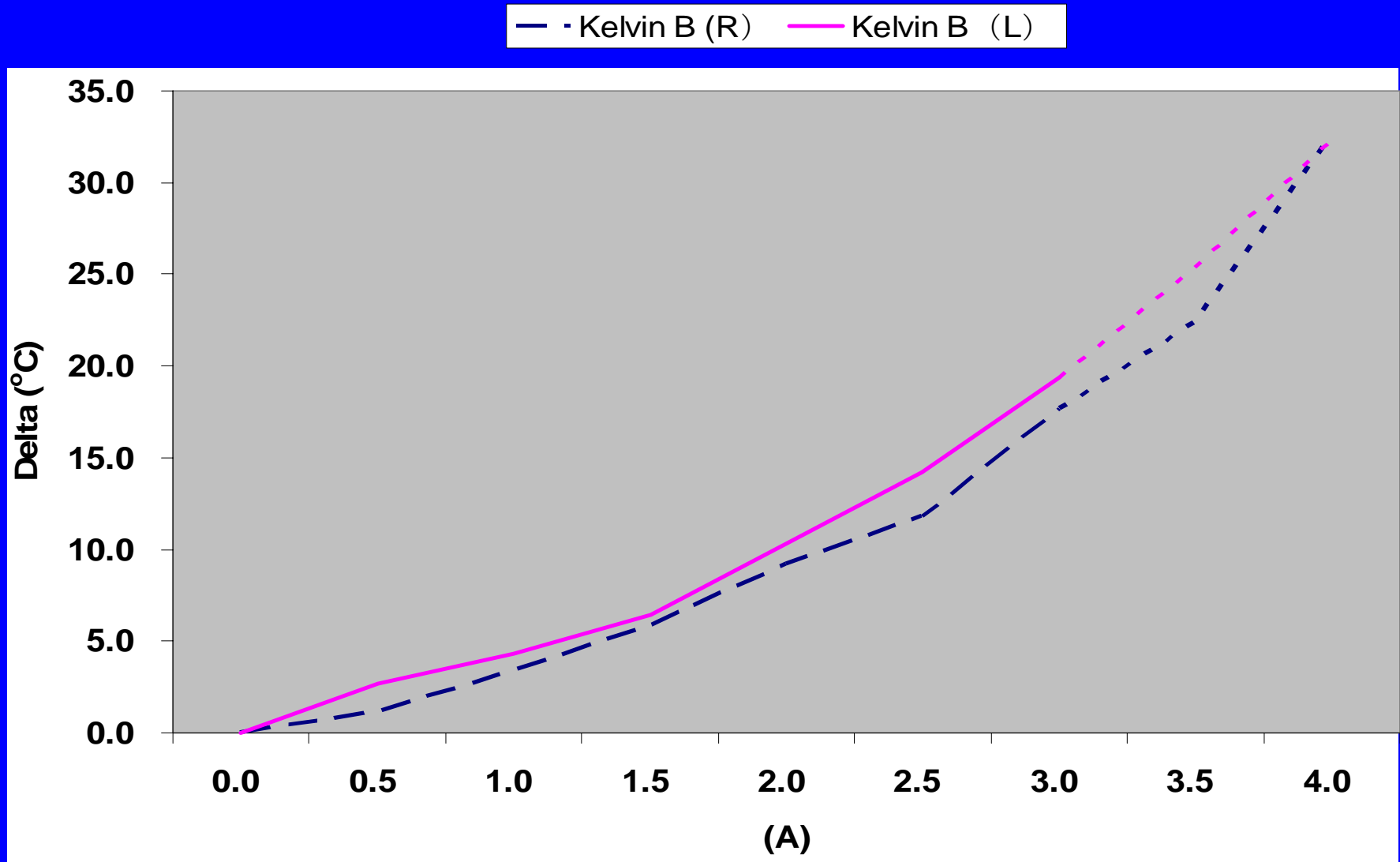
Operation



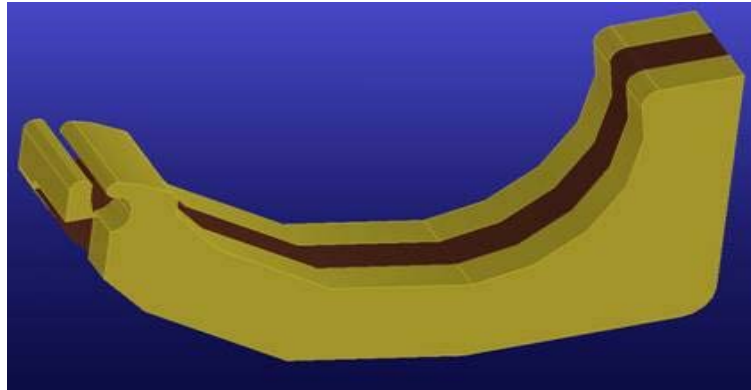
11/12/2002 March 7,
2005

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Kelvin Contact Test Socket (Burd/Megna)

Current Capacity



Kelvin B Specifications



J-Element Type	Kelvin B
Path Length	1.8mm
Inductance	0.58nH
Contact Resistance	0.03 Ohms
Contact Force	30 grams
Minimum Pitch	0.5mm
Current	3.0A
Overtravel	0.2mm

Production

– Initial set up

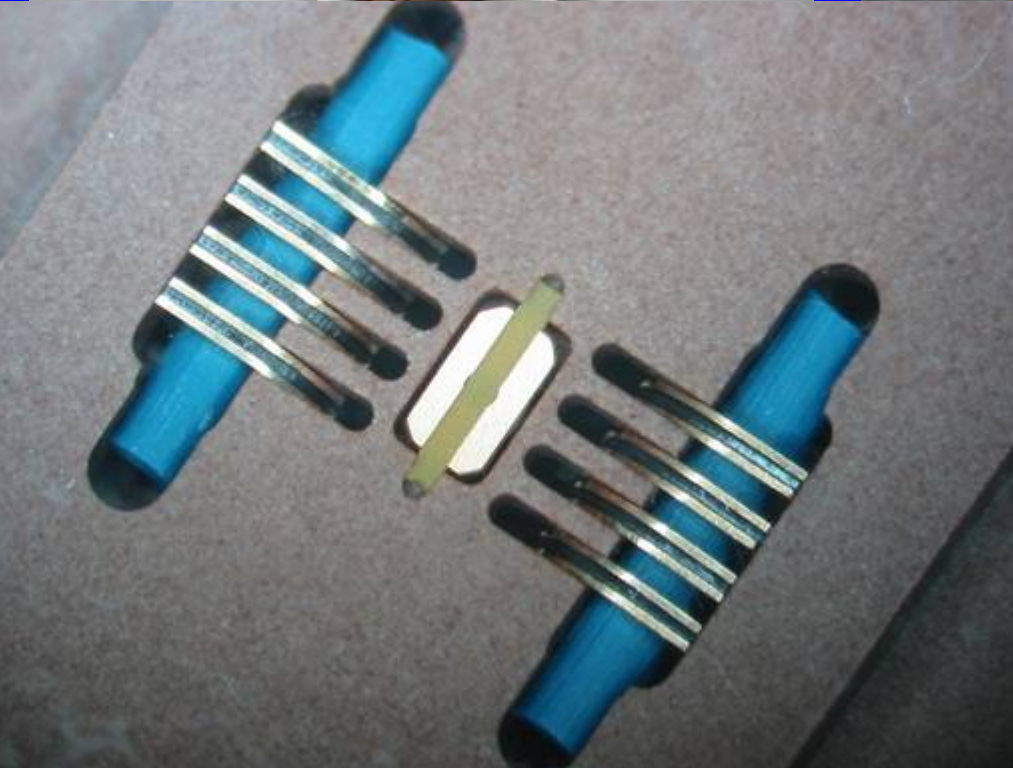
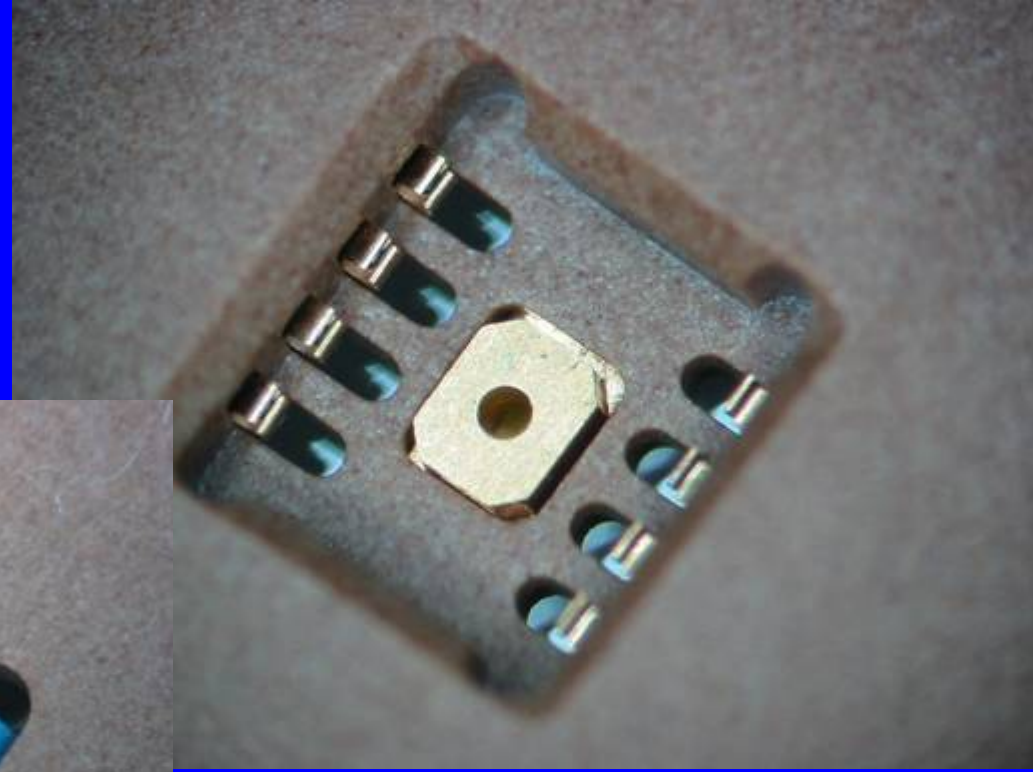
- 1000 devices @ 95°C = 100% yield
- 1000 devices @ RT = 100% yield
- 1000 devices @ -40°C = 100% yield

– Comparison

- Yield (Delta) = 6.3% Increase
- Maintenance
 - Pin Drop
 - Cleaning

– Initial

Production



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Kelvin Contact Test Socket (Burd/Megna)

13

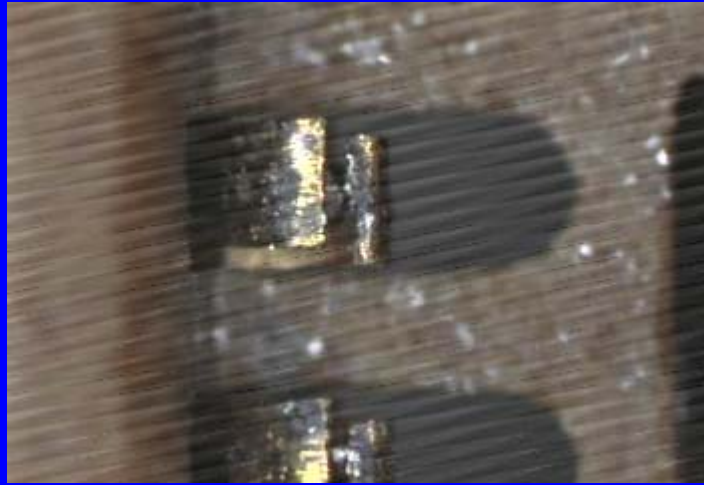
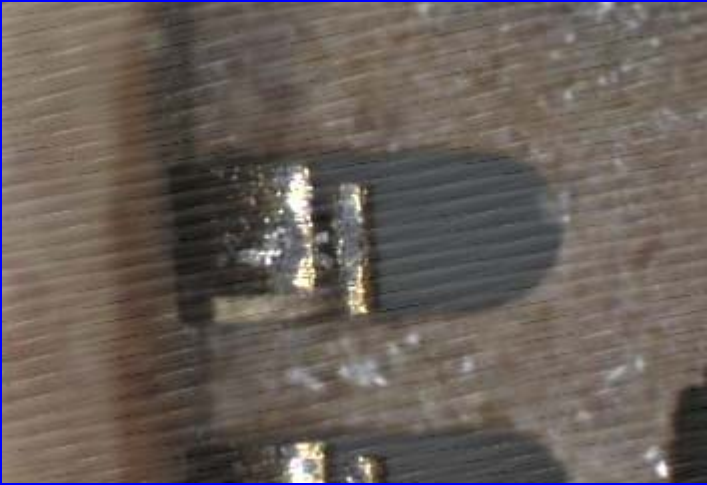
– 14K cycles

Production

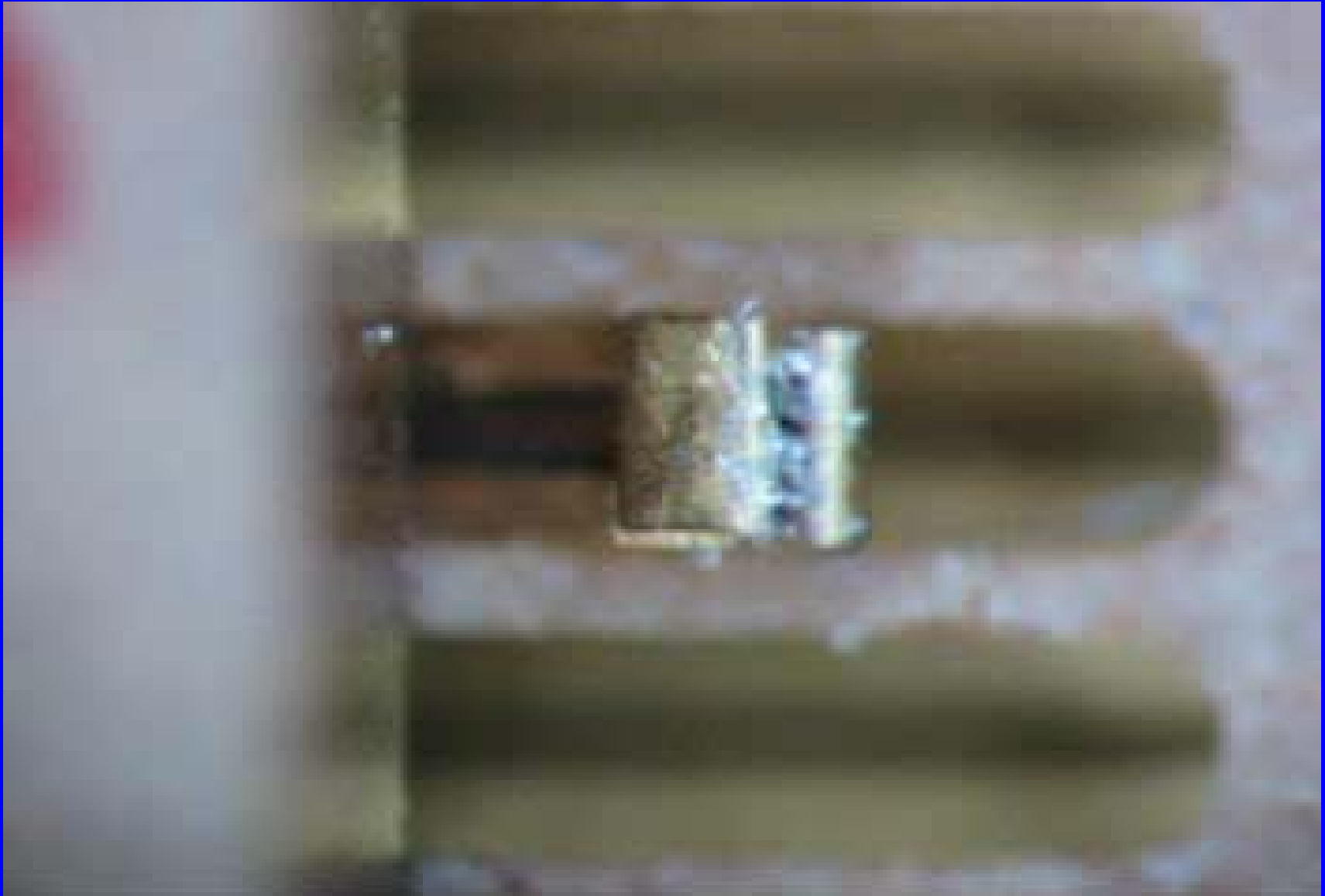


– 43K cycles

Production



Cleaning



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2005

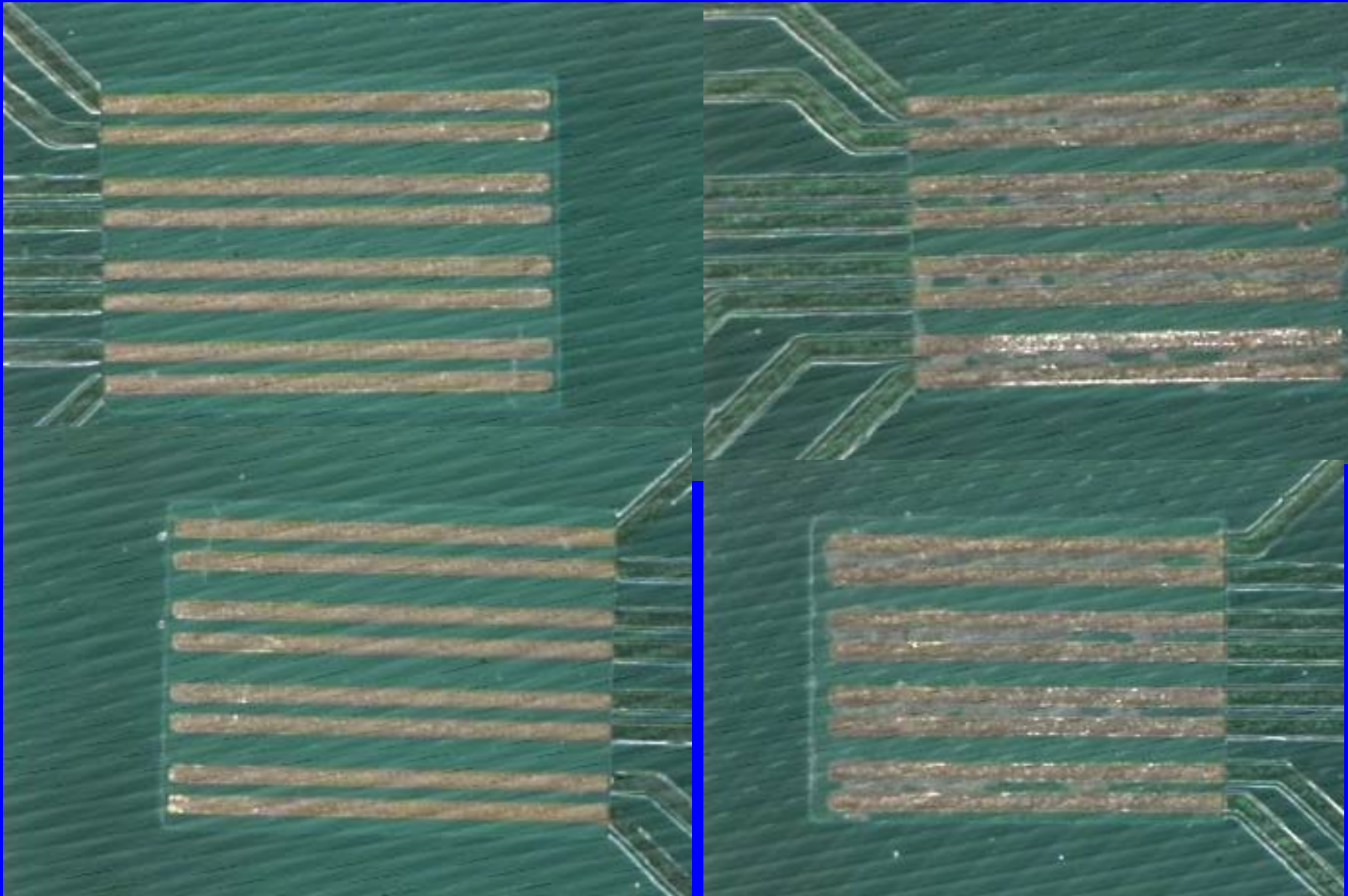
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Kelvin Contact Test Socket (Burd/Megna)

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– Initial

Production

– 14K cycles



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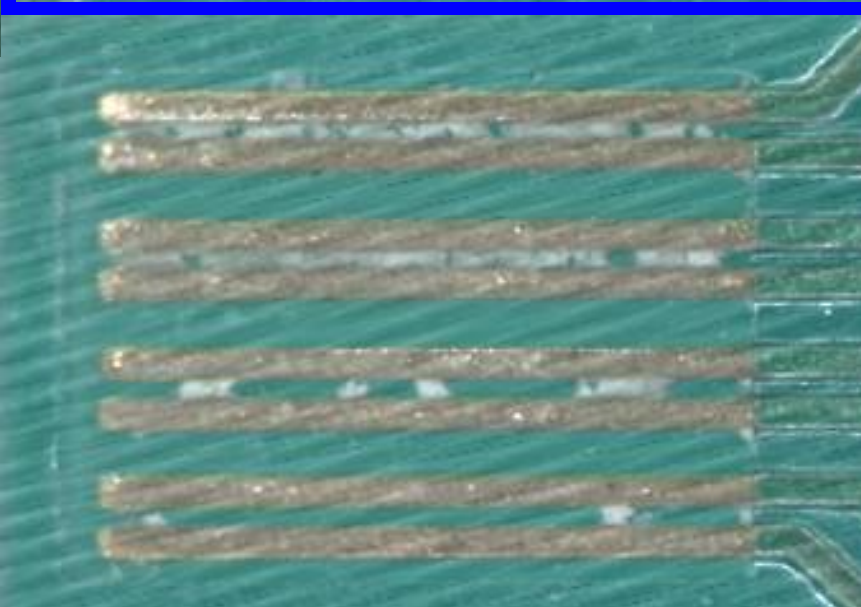
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Kelvin Contact Test Socket (Burd/Megna)

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– Initial

Production

– 43K cycles

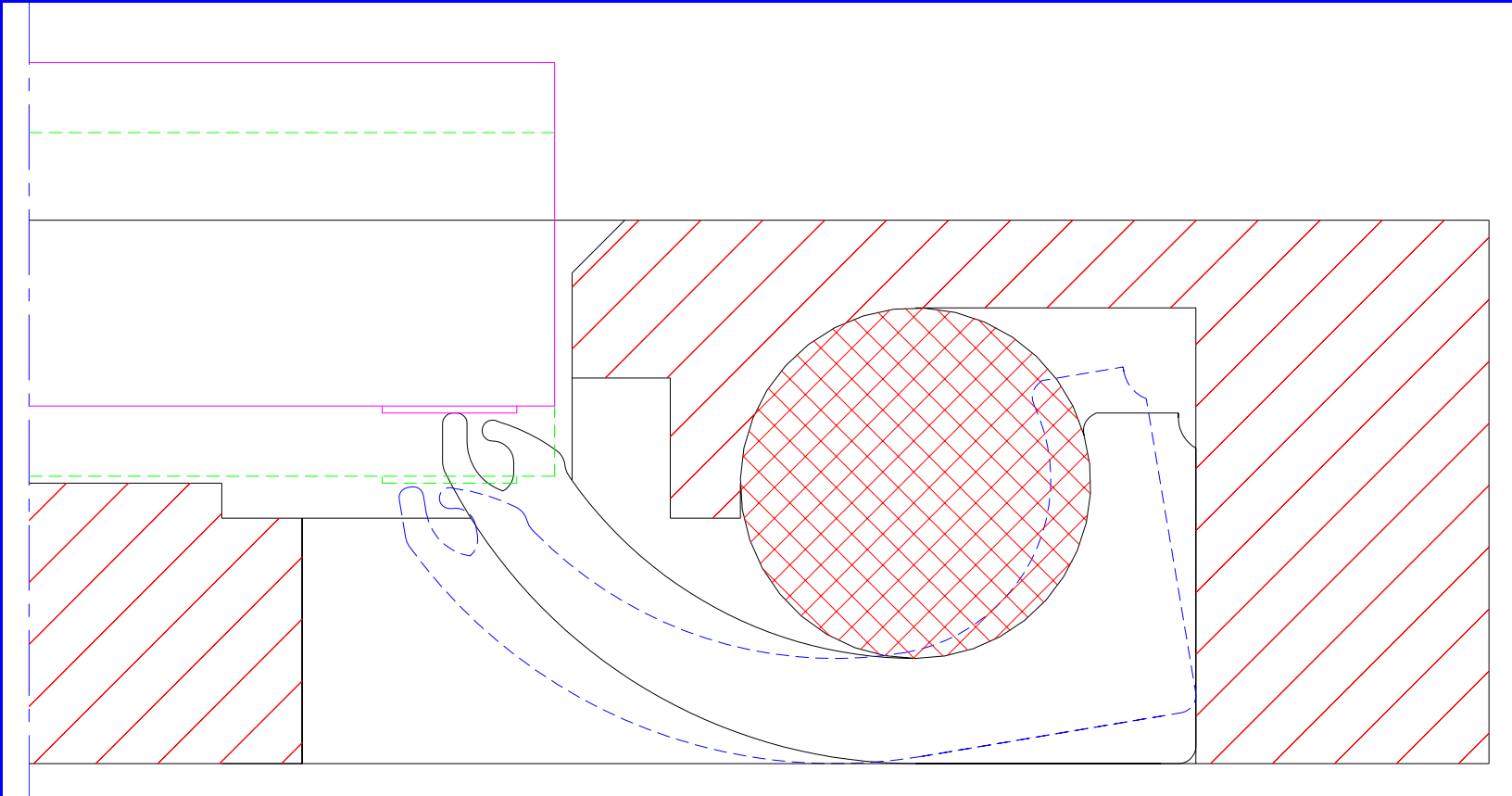


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2005

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Kelvin Contact Test Socket (Burd/Megna)

10

Longevity and Maintenance



- Rolling contact
- Single elastomer

Future Plans

- Additional Beta Site
- Manufacturing Robustness
 - Cleaning
 - Rebuilding
- Additional Packages
 - QFN

Acknowledgements

- Valen Burd
 - his idea
- Microchip US
 - Engineering Resource
- Microchip Thailand
 - Manufacturing Support
- MJC Japan
 - Design
 - Development
 - Support

Questions???

"Topless Burn-in Socket" - a Customer's Socket Standardization (follow-up to the key notes speaker 2004)

Holger Hoppe

Infineon Technologies AG

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Introduction

- Burn-in sockets (and boards) in memory mass production:
still very cost intensive
- Constant demand
 - ◆ decreasing cost per piece
 - ◆ longer socket (and board) life time
 - ◆ more universality for increasing package variety
 - ◆ high parallelism of sockets on burn-in boards
 - socket size as small as possible
- **New FBGA burn-in socket concepts needed!**

A g e n d a

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- State-of-the-art "Open top FBGA burn-in socket"
- The new "Topless" approach
- The route to standardization
- Conclusions

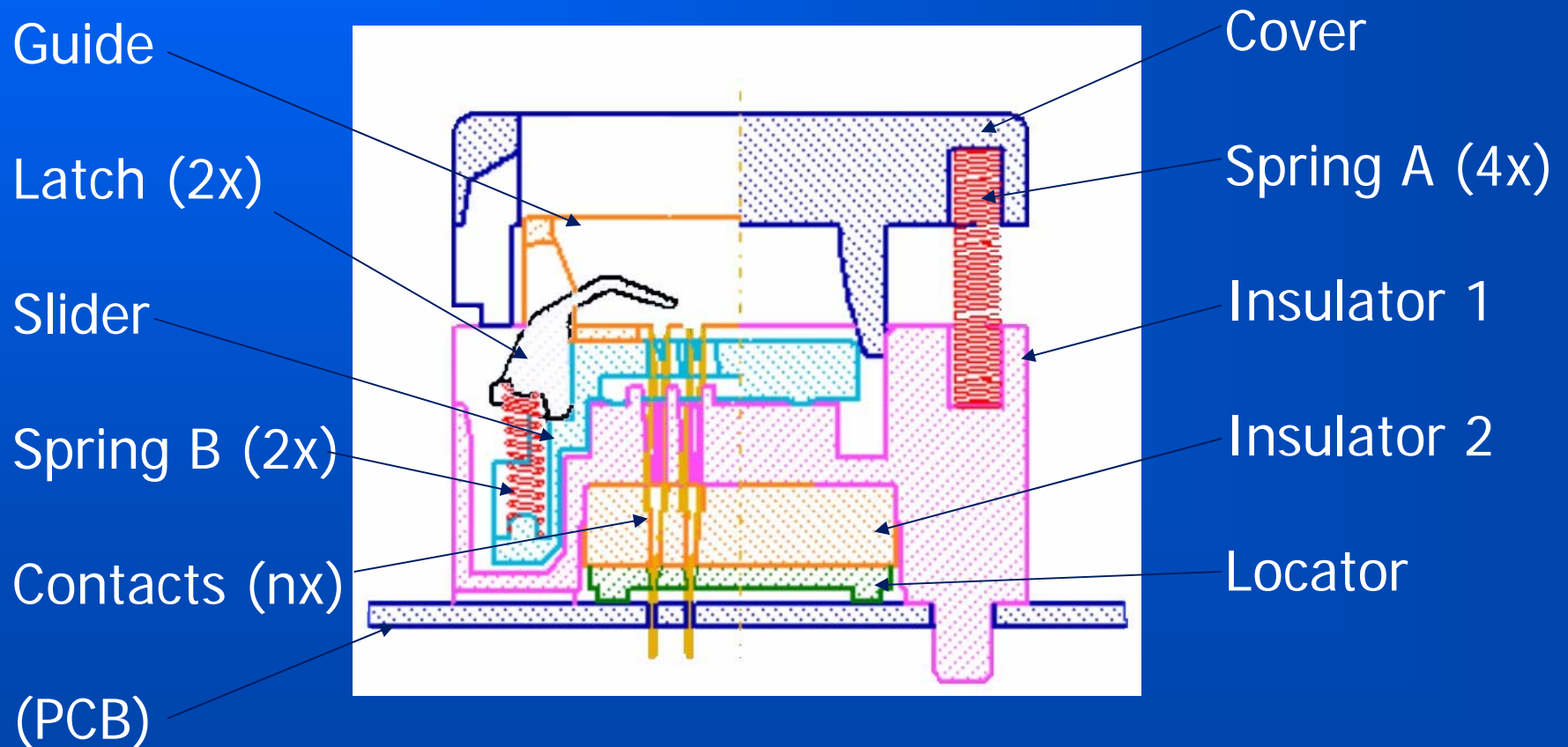
A g e n d a

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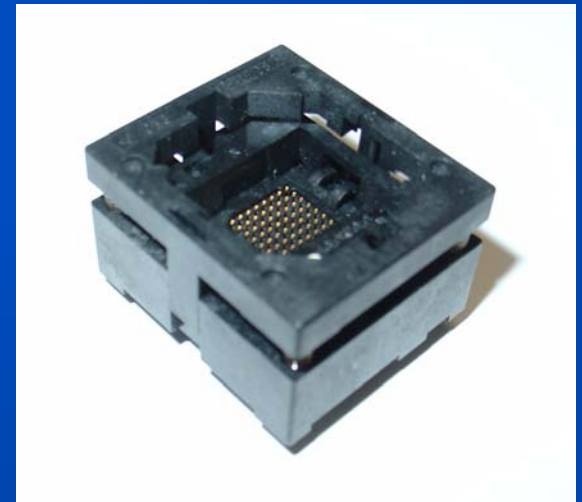
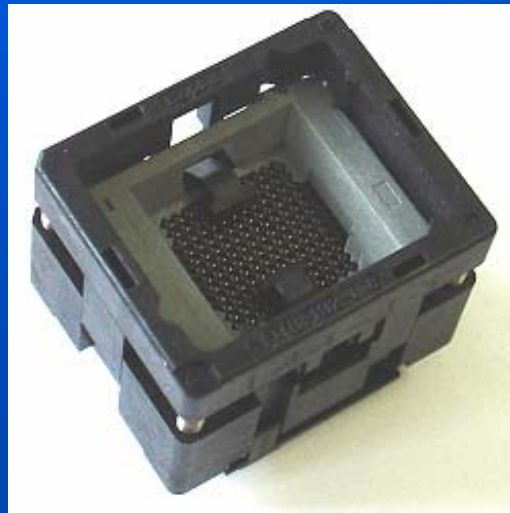
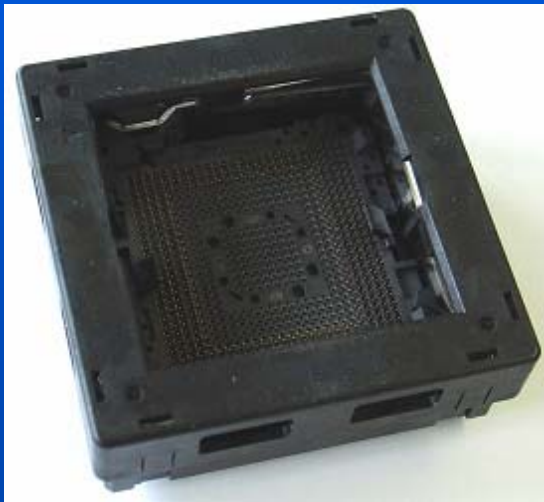
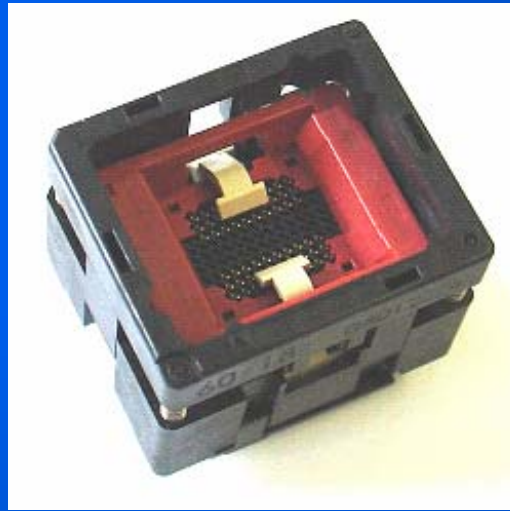
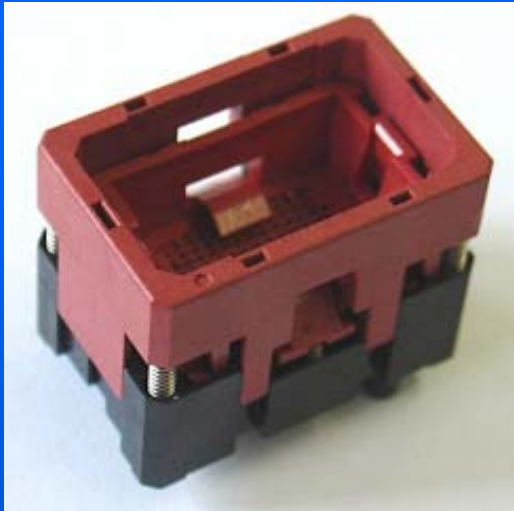
- State-of-the-art "Open top FBGA burn-in socket"
- The new "Topless" approach
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- Conclusions

State-of-the-art "Open top FBGA burn-in socket" (I)

- Overview: 10 different parts (in total ~ 70)



State-of-the-art "Open top FBGA burn-in socket" (II)



State-of-the-art "Open top FBGA burn-in socket" (III)

➤ Functionality

↪ Open latches and contacts while pressing down cover

↪ Rough and fine alignment of dropping device inside the socket

↪ Hold down device in right position while closing the cover

↪ Contact all balls

State-of-the-art "Open top FBGA burn-in socket" (IV)

➤ "How can the socket be simplified?"

- ↳ Every single socket contains same features and mechanisms e.g. Opening and Alignment.
- ↳ Loader / Unloader are much more precise today (accuracy $\sim 0.1\text{mm}$).
- ↳ Move functionality from the socket to the loader.
- ↳ Reduce number of parts → saving costs and space.

A g e n d a

- State-of-the-art "Open top FBGA burn-in socket"
- The new "Topless" approach
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The new approach "Topless" (I)

- Coverless → Open socket directly with the loader head
 - ↳ Remove cover
 - ↳ Remove 4 springs
 - ↳ Loader head to be aligned precisely on socket
 - ↳ Slider and Latches directly actuated by loader head

The new approach "Topless" (II)

➤ Guideless → Use "perfect" accuracy of loader

↳ Preciser guarantees accurate position of device at loader head

↳ Removing the guide "opens" the socket for wide range of package sizes

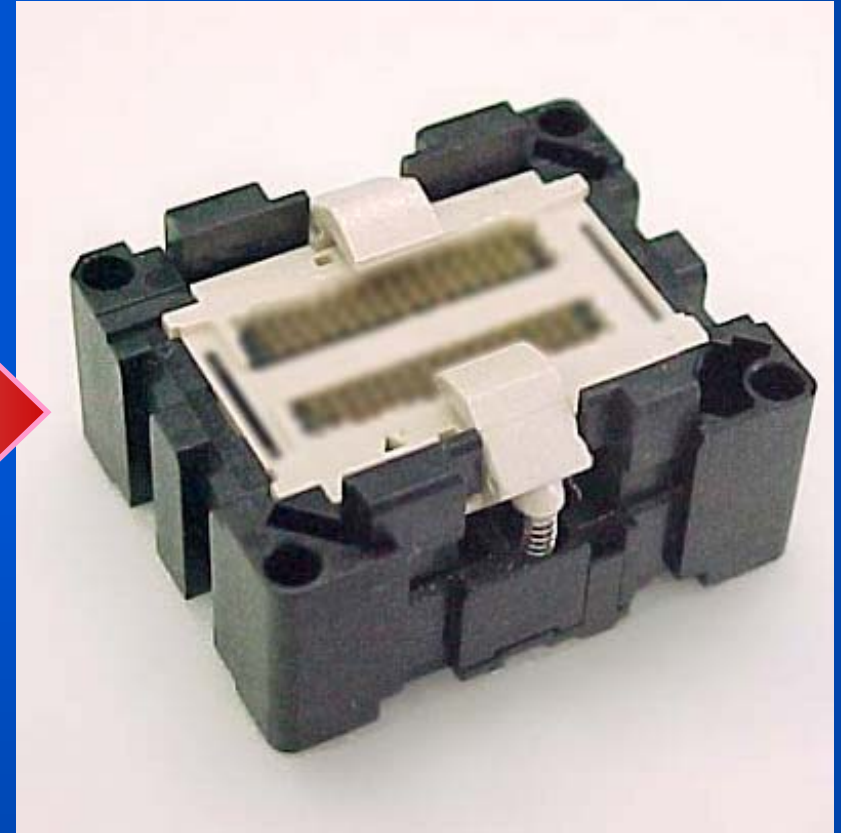
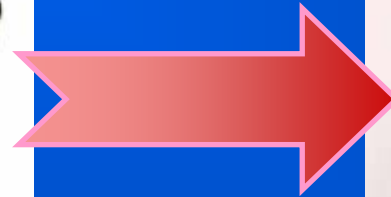
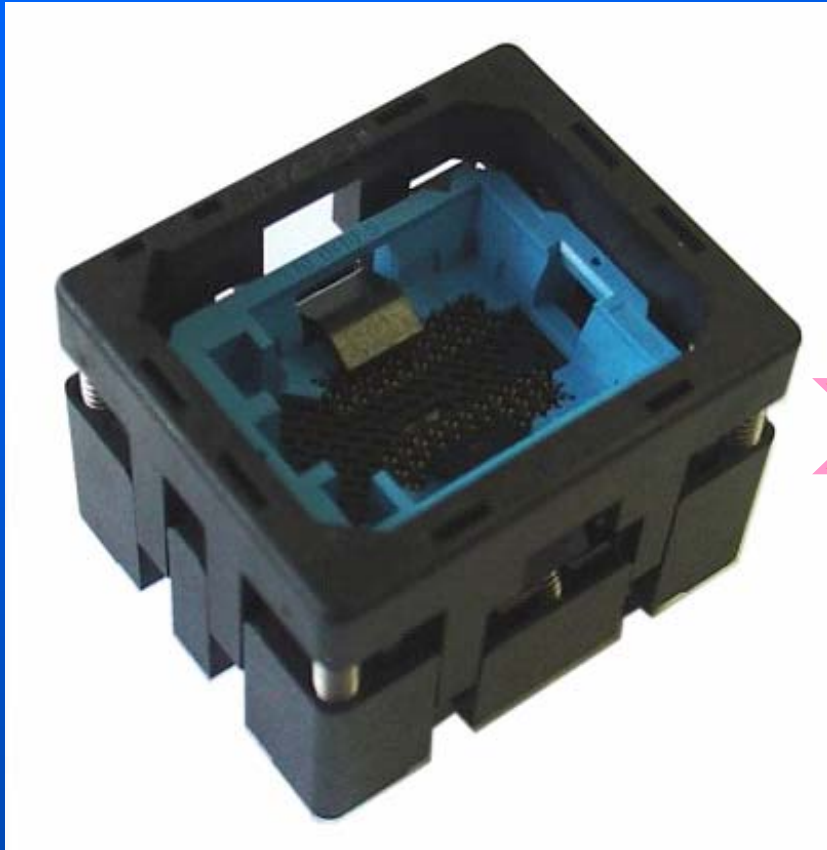
↳ Fine alignment only by "top plate"

↳ Air flow over device improved

Coverless + Guideless = Topless (patents pending)

The new approach "Topless" (III)

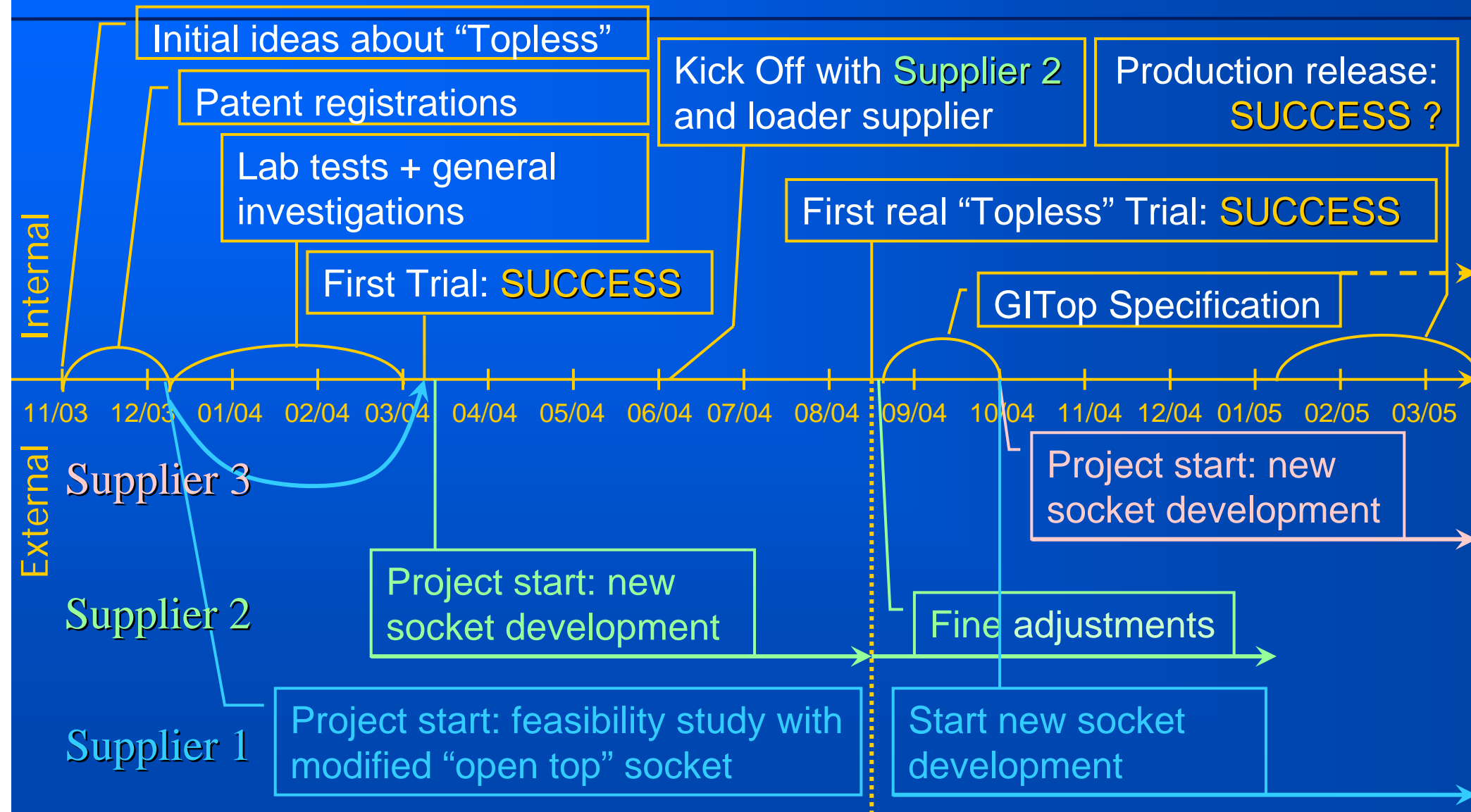
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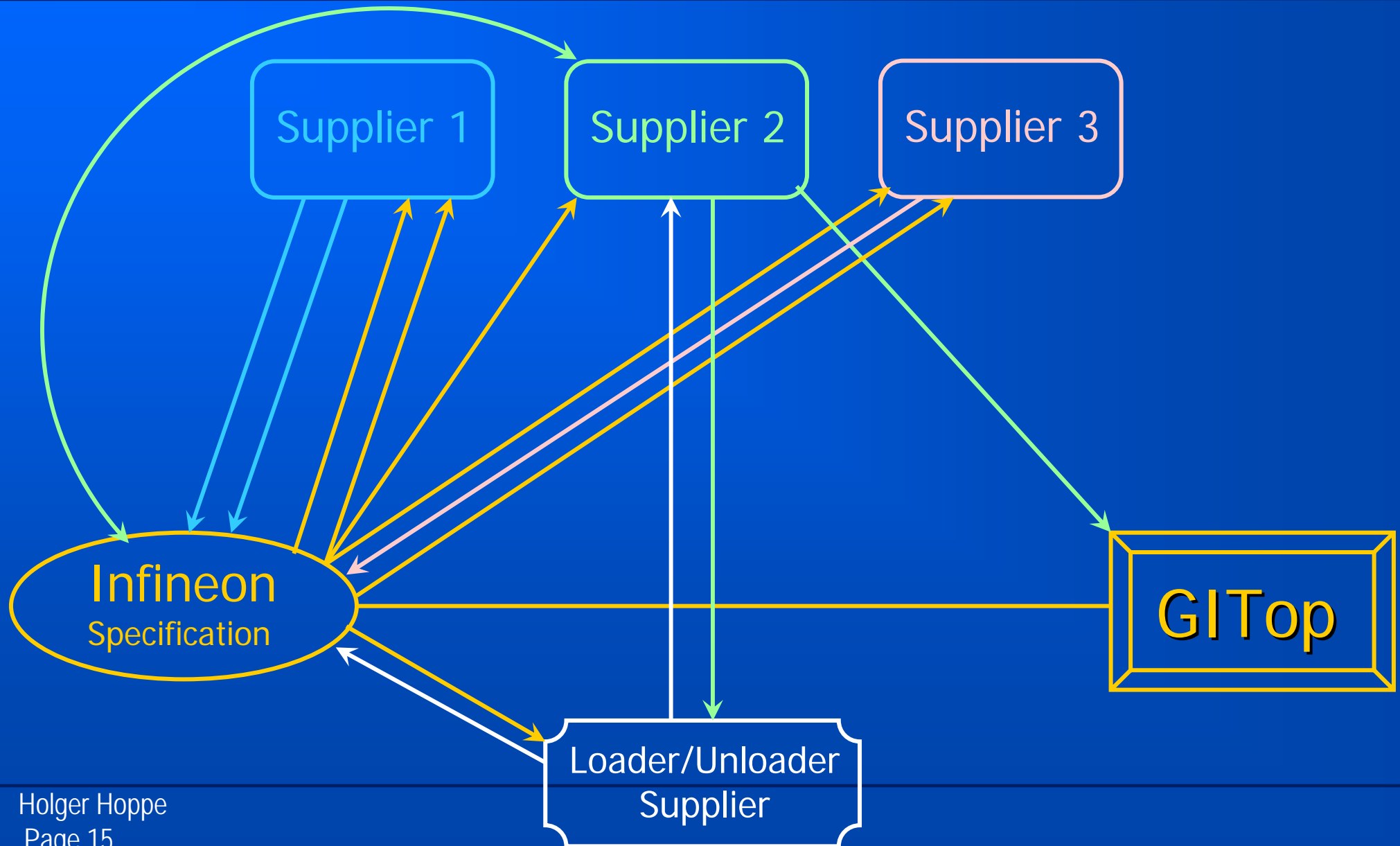
- State-of-the-art "Open top FBGA burn-in socket"
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- The route to standardization
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The route to standardization (I)



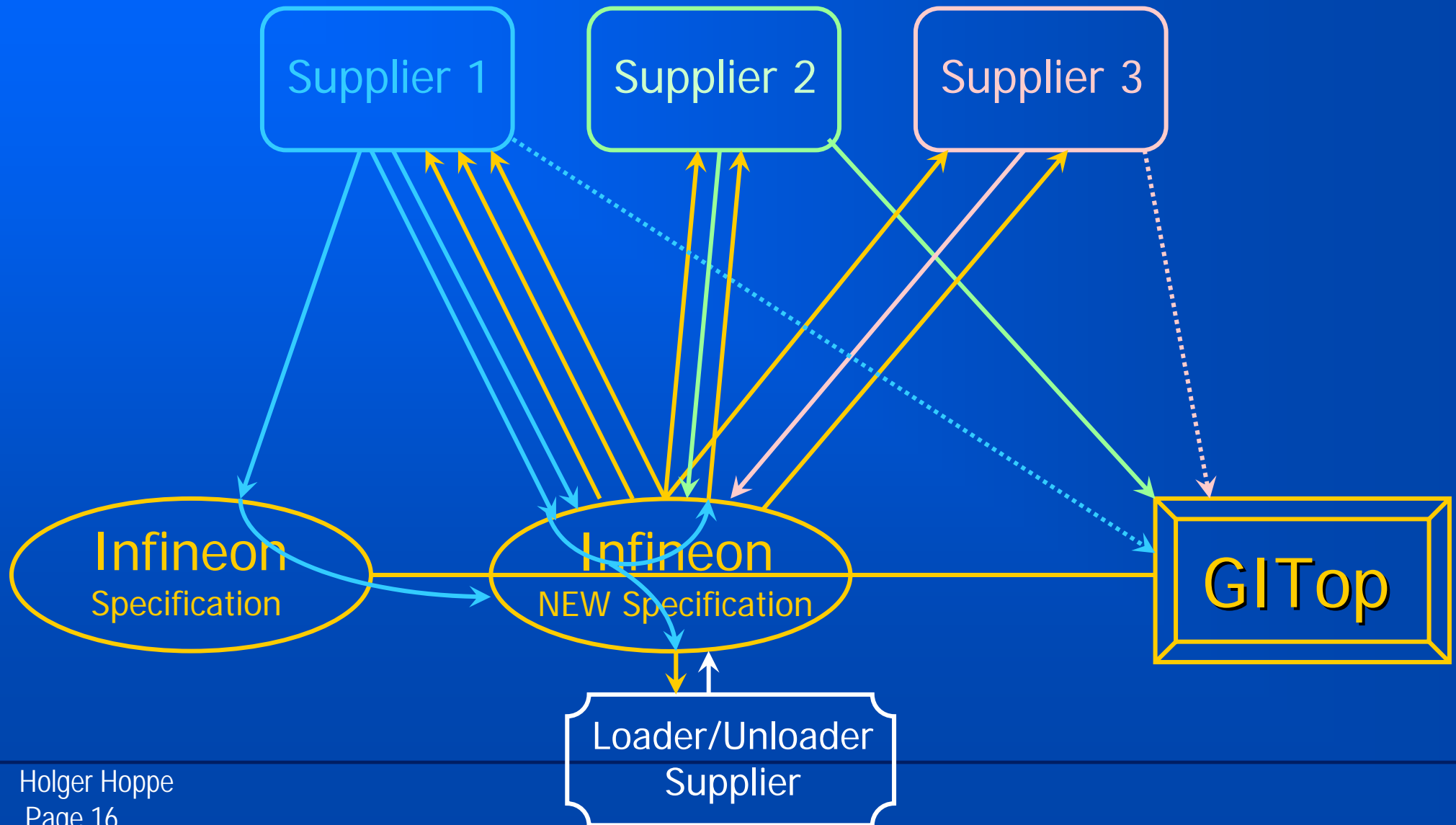
The route to standardization (II)

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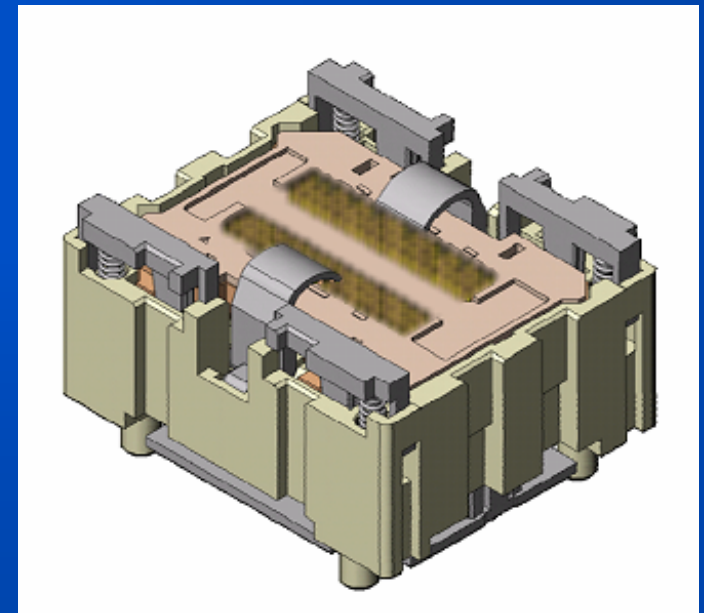
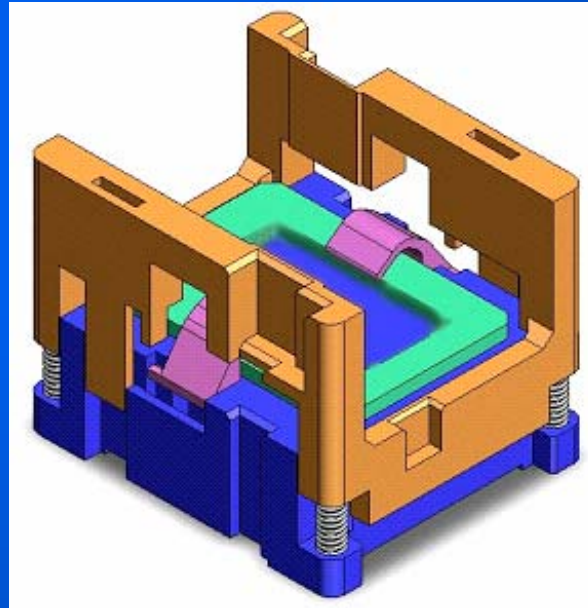
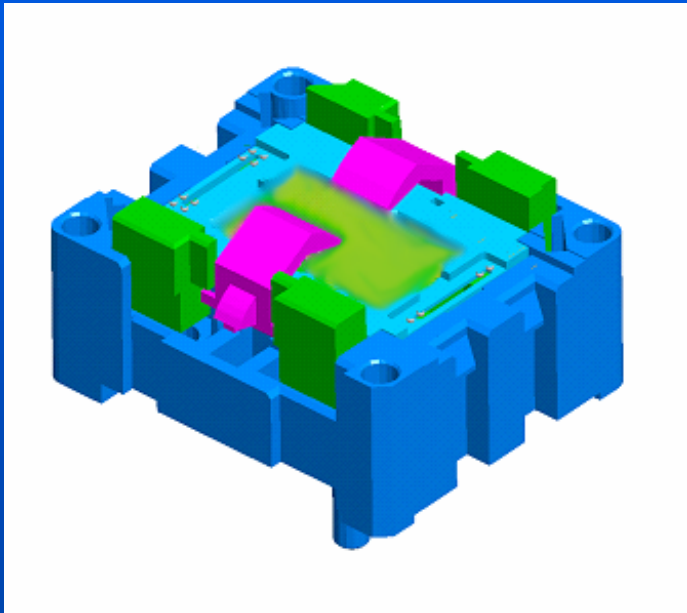
The route to standardization (III)

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The route to standardization (IV)

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A g e n d a

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March 6-9, 2005

- State-of-the-art "Open top FBGA burn-in socket"
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Conclusions (I) – Topless Burn-in socket

- New loader/unloader generation allows new socket concept.
- New socket concept is very promising.
- Cover for socket actuation is not needed anymore.
- Guide for device alignment is not needed anymore.
- Reduced socket price.
- One socket can handle many devices.
- Final production release still open (expected mid of March 05).

Conclusions (II) – Standardization process

- Quite difficult to combine 3 supplier technologies (+ 1 Loader manufacturer)
- Each supplier is trying to introduce and prevail its own technology and ideas.
- It needs a lot of communication, each major change has to be forwarded and aligned with all other parties.
- Avoid more than 2 suppliers!
- Try to determine all facts in your specification and avoid any “softening” of YOUR specification.
- **BUT: At the end of the day you'll get 2 or more compatible, cheap, well performing products according your wishes (?) and a good competition between your suppliers!**

Thank You !

Thanks to

Yamaichi Electronics
www.yamaichi.co.jp



Enplas Semiconductor
www.enplas.com



Texas Instruments
www.ti.com



Questions?



Systems and Technology Group

The Case for a Universal Socket Footprint

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John Mendes

IBM Corporation
Essex Junction VT

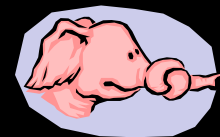
Agenda

- Introduction: Socket Footprints
- Vendor's Galore
- Application Diversity
- Board Layout Configurations
- Direct (Drop-In) Field Replacement
- Footprint Overlay

Introduction

■ Socket Footprints

- Are like noses – everyone has one
- Come in all shapes and sizes
- Not compatible from device to device
- Not compatible from vendor to vendor
 - Anyone wonder why?
- Designs are almost always vendor driven
- Little attention paid to this subject



Vendor's Galore

- Multiple Vendors commonality
 - Unique footprint design
 - Able to modify existing footprints
 - Competitive pricing scales
- Manufacturer Sources
 - www.ChipScaleReview.com

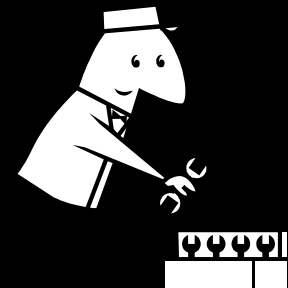
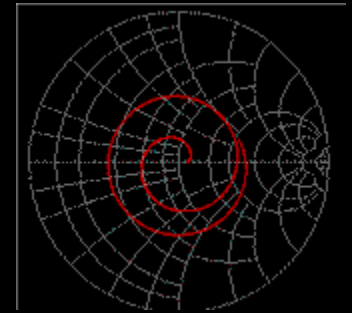
Application Diversity

- Electrical Performance

- High Frequency/Bandwidth ($> 3\text{GHz}$)
- Low Noise/Crosstalk
- Contact Inductance

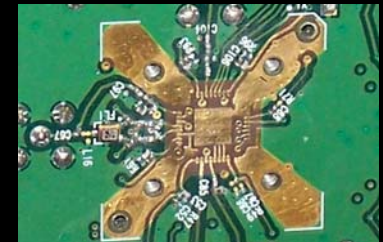
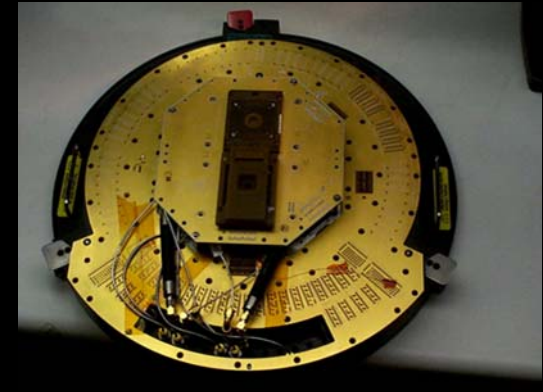
- Mechanical Performance

- Compliance
- Insertion Cycles
- Cleaning
- MTBF (Mean Time Between Failure)
- MTBM (Mean Time Between Maintenance)



Board Layout Configurations

- Board Area
 - Single vs. Multi DUT
- Device Decoupling
- Thru-Via and Probe Pad Placement
- Component Placement Restrictions
- Balanced/Matched Network Circuitry
- Handler Kit Configuration



Direct (Drop-In) Field Replacement

- Conditions invoking changes
 - Test Application
 - Device Physical Characteristics
 - Field Engineering Methods
 - Tester or Manufacturing Equipment
 - Commodity Price
 - Flexibility

Footprint Overlay

- Socket types
- Device Pockets
- Mounting Topology
- Multi-DUT
 - Quad – Octal
- Working with vendors

Footprint Overlay (Cont')

■ Socket Types

LGA

CSP

BGA

uBGA

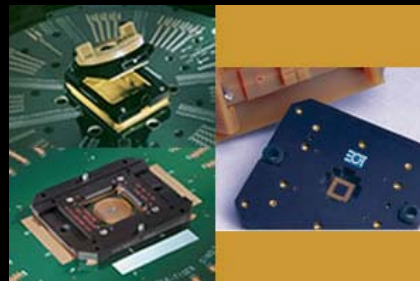
QFN

PLCC

QFP

PGA

MLF



Footprint Overlay (Cont')

- QFN 5x5 Example
- Device Pad Layout
- Vendor1 Layout
- Vendor2 Layout
- Vendor1 and Vendor2 Overlay
- Combined Socket Overlay
- Device Pocket Overlay (zoom)

Conclusion

■ Benefits

- Universal Hardware
- Compatible with existing Handler Kits
- One footprint for all devices
- Interchangeable between vendors
- Same device pad layout configurations
 - Offset vs. linear contacts
- Flexible field replacement
- Hardware Cost reduction

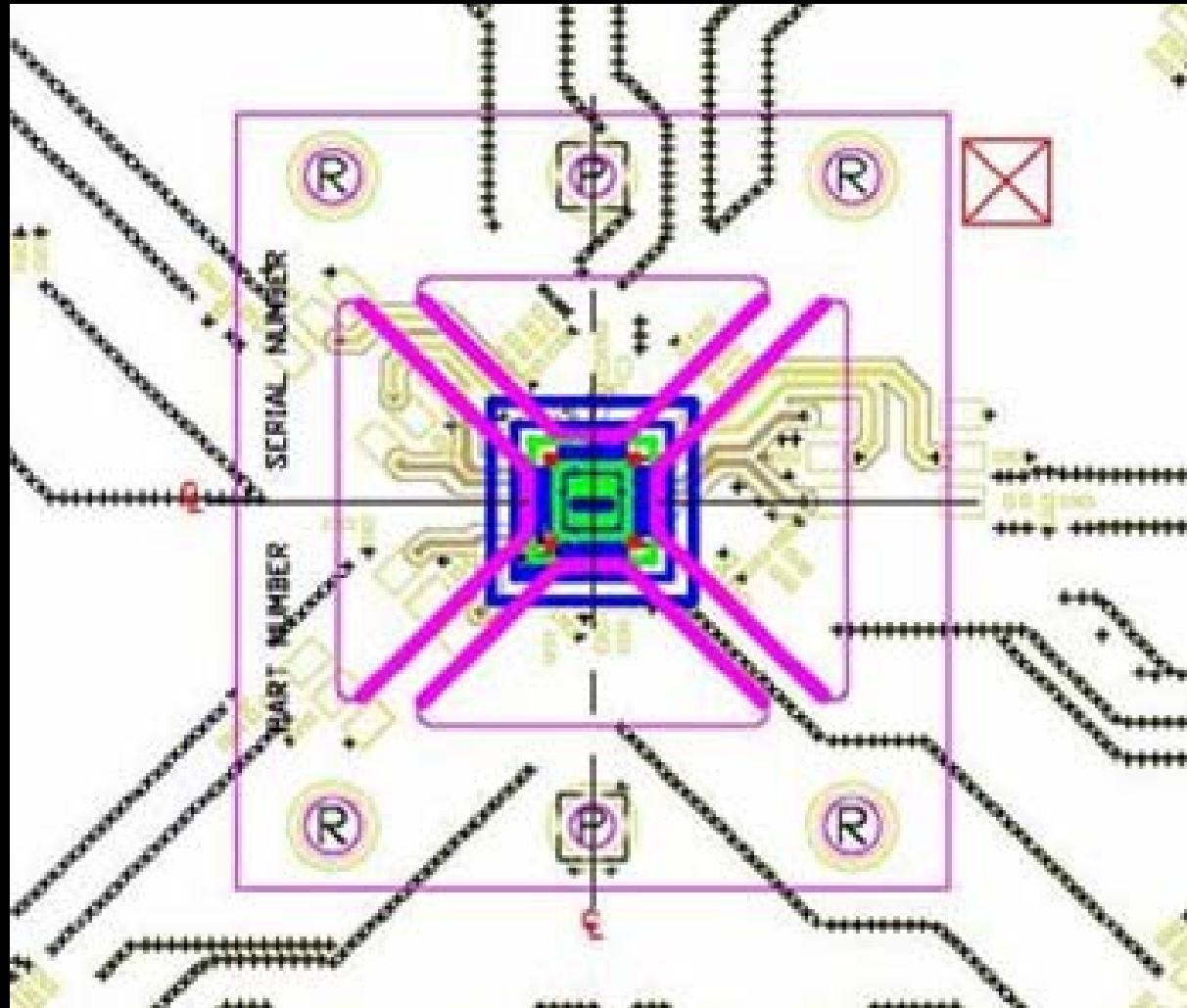
Conclusion (cont')

■ Possible Drawbacks

- Technical Feasibility
 - Geometries too complex
- Costly to implement
 - New tooling / Complex machining
- No buy-in by vendors
 - Forget about it
- Large Physical Aspects
 - ASICs, PowerPC, etc.
- Limited Application
 - BGA's, LCC's, MLF's, QFN's

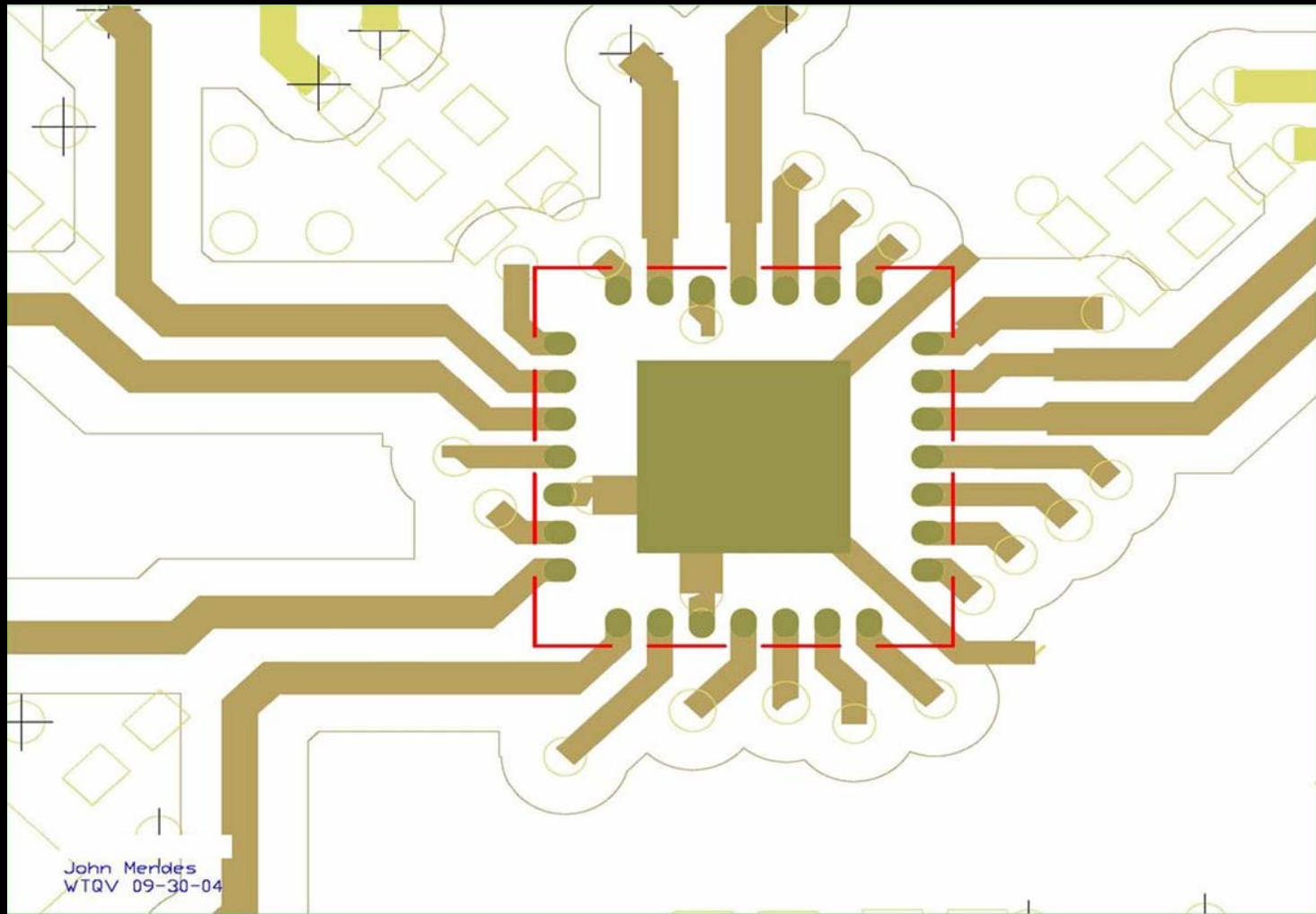
THANK YOU

QFN 5x5 Example Layout

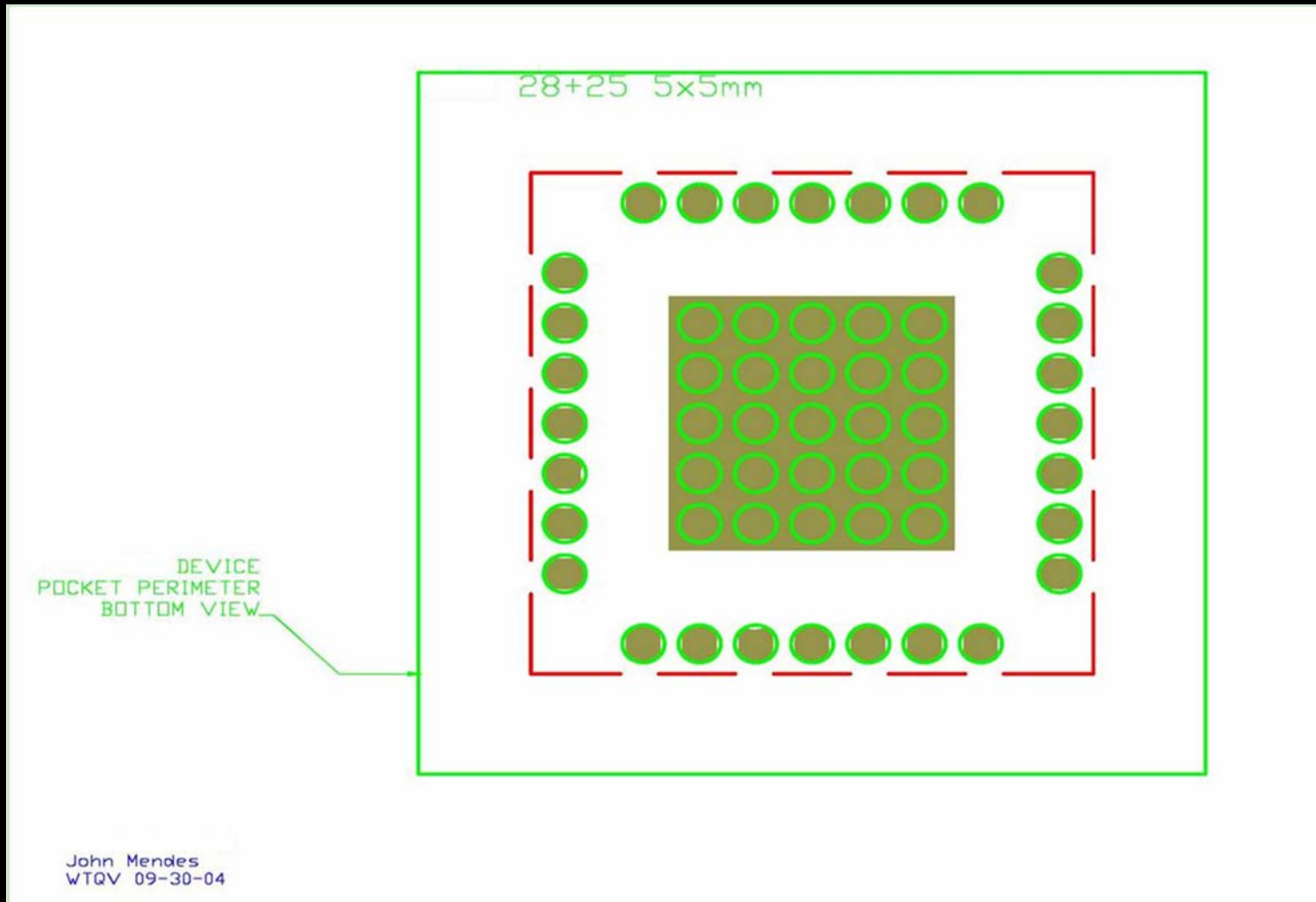


◀BACK

Board Pad Layout

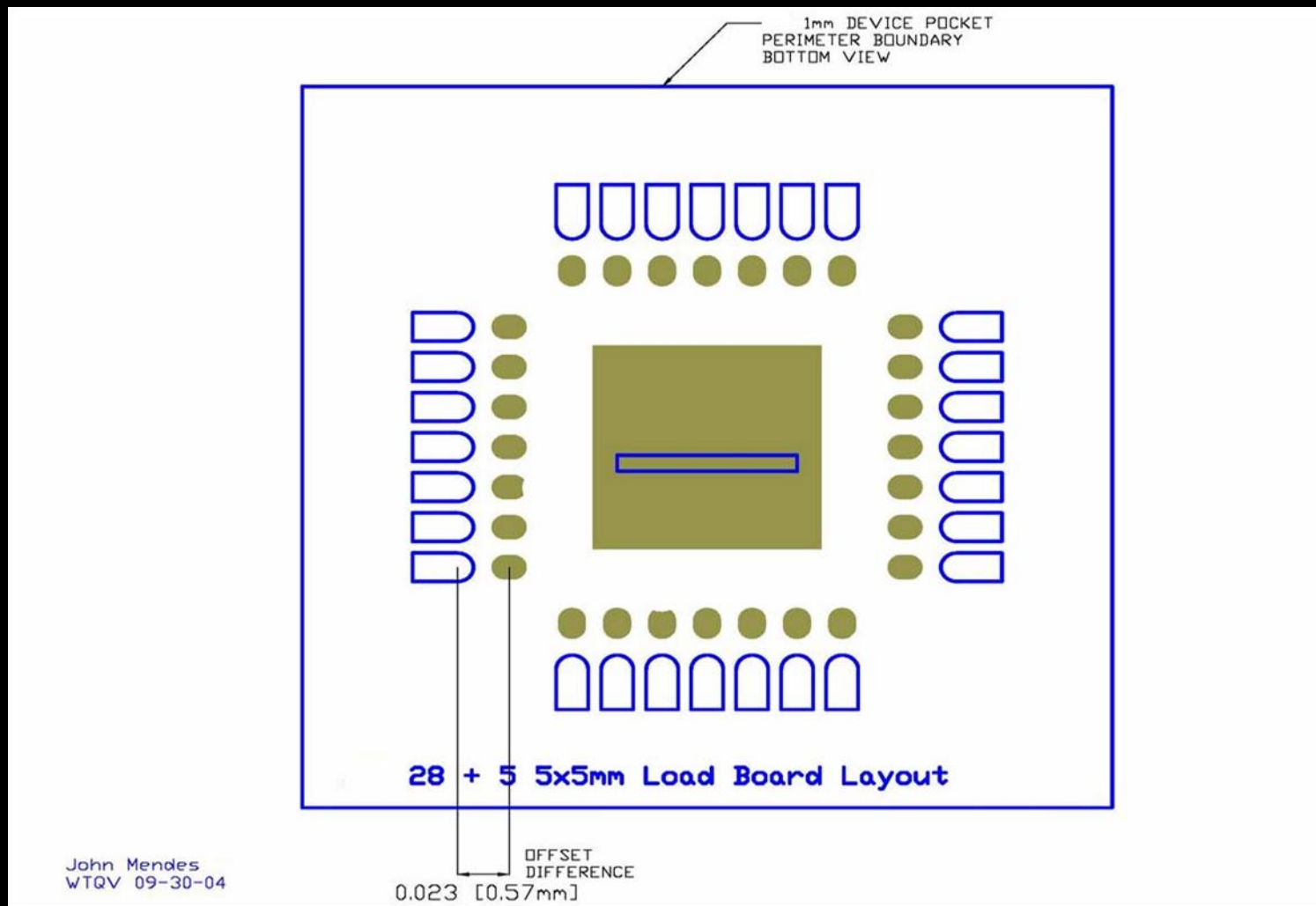


Vendor1 Board Pad Layout



BACK

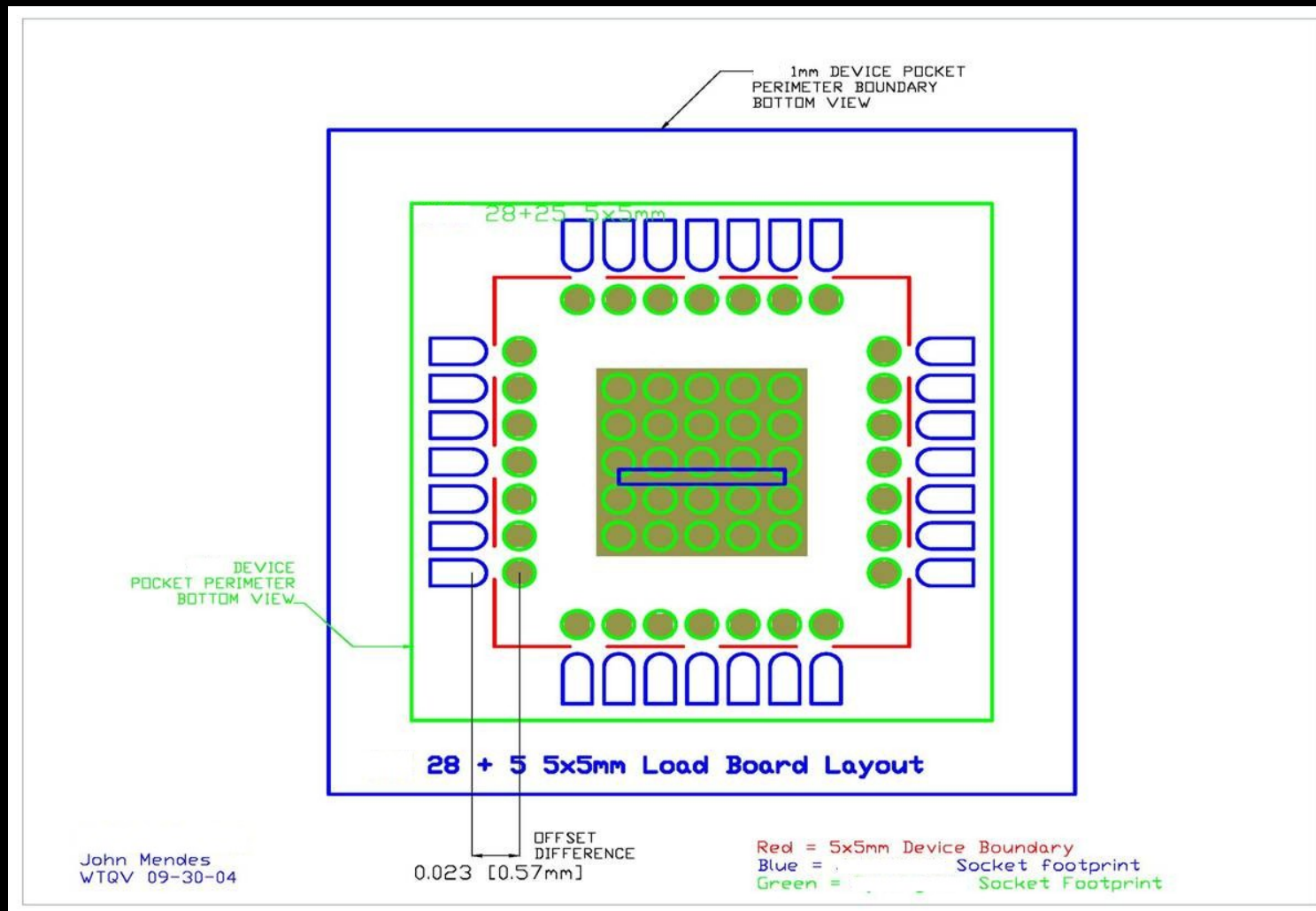
Vendor2 Board Pad Layout



John Mendes
WTQV 09-30-04

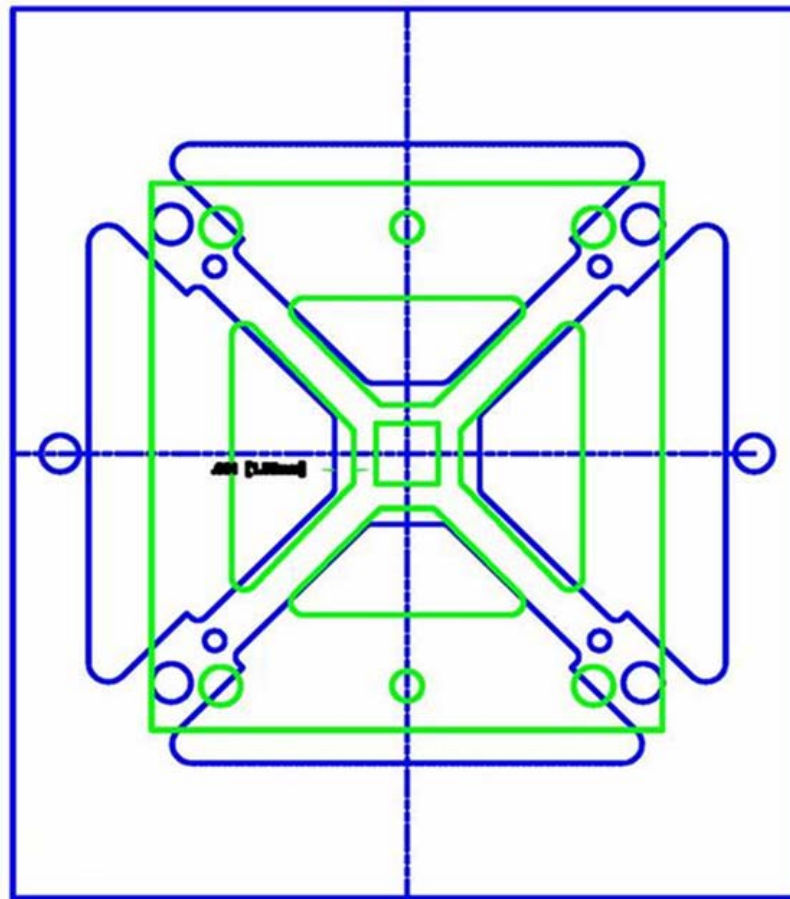
BACK

Vendor1 and Vendor2 Overlay



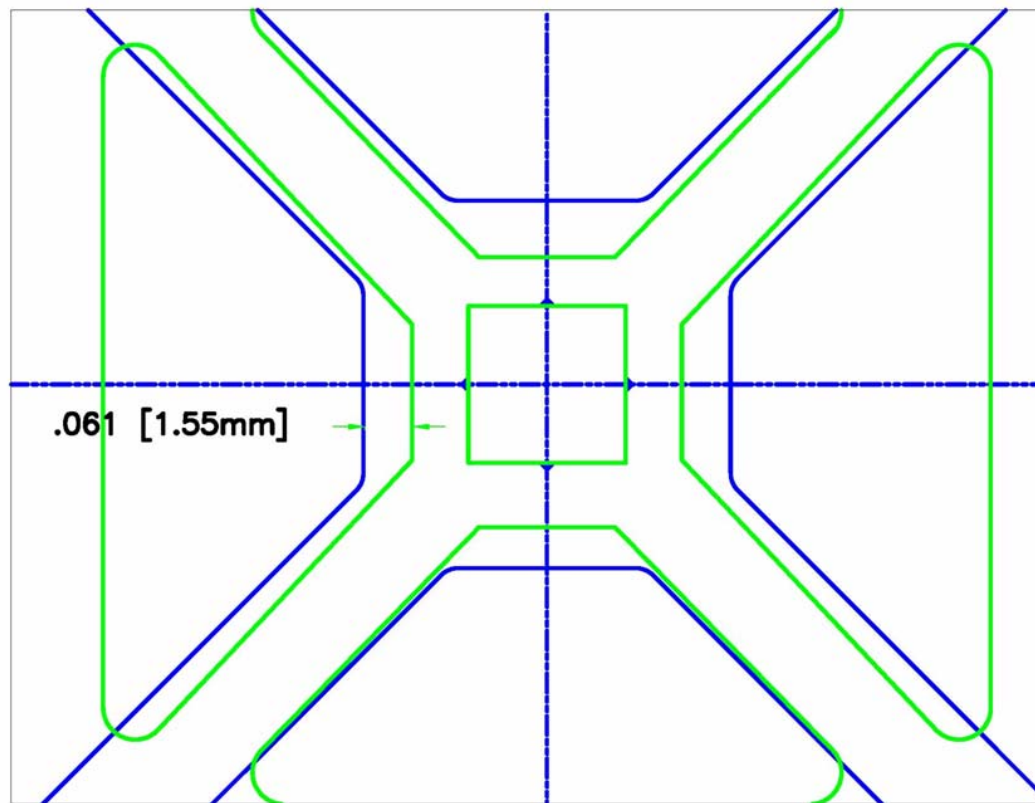
BACK

Combined Socket Overlay



BACK

Device Pocket Overlay (zoom)



John Mendes
WTQV 10-13-04

◀BACK