BiTS Burn-in & Test Socket Workshop 2008 Session 3

ARCHIVE 2008

SOCKETS: ON THE FLOOR, IN THE LAB

"Contactor Selection Criteria Overview for RF Component Testing"

James Migliaccio, Ph.D
RF Microdevices

"Design Optimized, Manufacturing Limited - A 250W Thermal Solution"

Trevor Moody, Kevin Hanson, Rick Davis
Antares Advanced Test Technologies

"Test Socket Tracking: From Cradle to Grave"

Angelo Giaimo
IBM Corporation

Contactor Selection Criteria Overview for RF Component Testing

2008 Burn-in and Test Socket Workshop
March 9 - 12, 2008

James Migliaccio, Ph.D.
RFMD

Overview

We'll take a lighthearted look at one RF test guy's criteria for socket selection

I'll give a couple examples of the good and not so good

Finally, toss out a need for looking at the problem a little differently

Customer View of Contactor Supplier

3/2008 Contactor Selection Criteria Overview for RF Component Testing 3

Contactor Supplier View of Customer

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RFMD PA TEST

- Tried/used many different contactors for RF test:
  - Spring Probes
  - Sliders
  - Rockers
  - Interposers
  - Particle Interconnect
  - Fibrous Gold Balls
  - Cantilever
- Most consist of a plastic body holding small metal pieces in place

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Mechanical Requirements

- Tolerancing and relationship to the handler
- Material composition
- Cost vs. life balance
- Competitive cost of ownership
- Field serviceable
- Documentation
  - Assembly drawings with part numbers
  - Training and maintenance procedures
  - Cleaning and lifetime interval recommendations

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Electrical Requirements

- Typical DUT has low pin count
- Mix of RF & DC pins
- Current requirement can exceed 2A on a pin
- May need to have external components close to the DUT
- Minimal ground inductance preferred
- PCB Real-estate concerns
- RF performance
- ESD

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Other Considerations

- Acquisition Costs
- Existing Relationship
- Anything New and Innovative
- Unique DUT or close relative of existing product
- Custom or standard package?
- Part pad composition
- Accelerated mechanical life testing
- NDA
- Changing design is very painful
- Cres is not an important data point. We measure RF performance directly and use an SPC system to determine performance.
- Will go to production

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What Can Go Wrong, Will

- Vendor expertise and experience is exaggerated
- Schedules are not met
- Socket stops working on the second insertion
- Load board issues
- Long time for feedback

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Trying Something Different

- Application: 3x3 QFN PA
- Previous contactors were not optimum for first pass yield and longevity
- Tried 3 solutions in parallel – two using new contactors
- Vendors built contactors at their expense
- 3 Layouts, PCBs, assembly, code, docs
- Engineer's time
- Tester time
- Phone conferences, etc.

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The Big One - Cost

- Initial development cost
  - Sockets, load boards
  - Time
- Production Cost
  - Initial
  - Replacements, spares, training
  - Down time - yield
  - Re-use
- Know the alternative – price & performance
- Service/Quality/Reliability are the great equalizers

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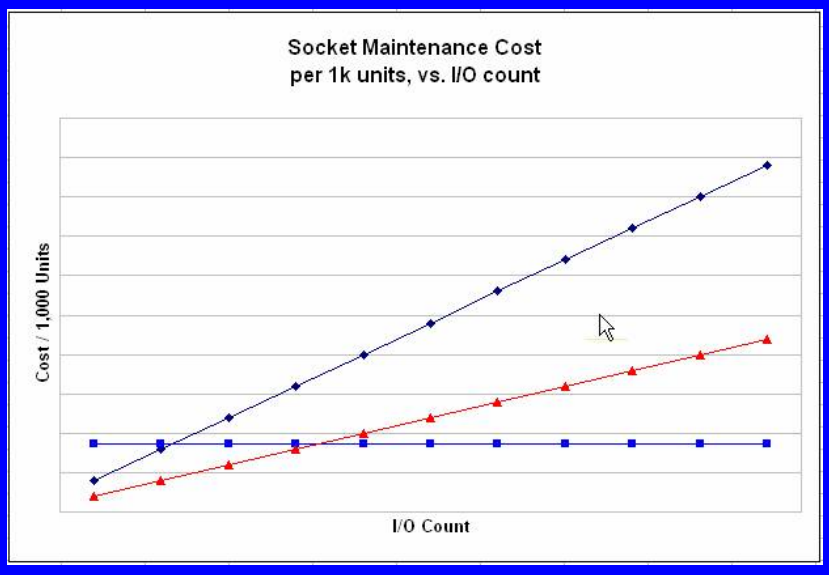
What does it all Mean?



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From Socket to Application

- Socket maintenance cost is a function of contactor lifetime and repair cost
- This chart ignores the cost of tester down time, labor, spares and first pass yield loss
- Although lifetime cost is a major factor, performance is king
- Not all performance variation is associated with the socket
- Final application can change everything

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Application Implications

- Interaction between DUT, Socket and Handler
- Socket and Handler are often designed separately
- Non-Linear effects change the way test data correlates to reference
- Ideally have test environment mimic application environment
- Need handler and socket to simulate shielded environment

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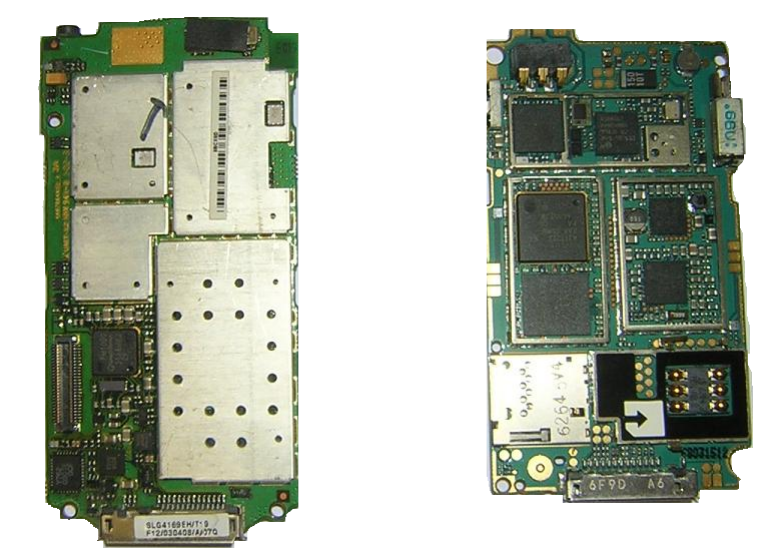
Typical Final Application



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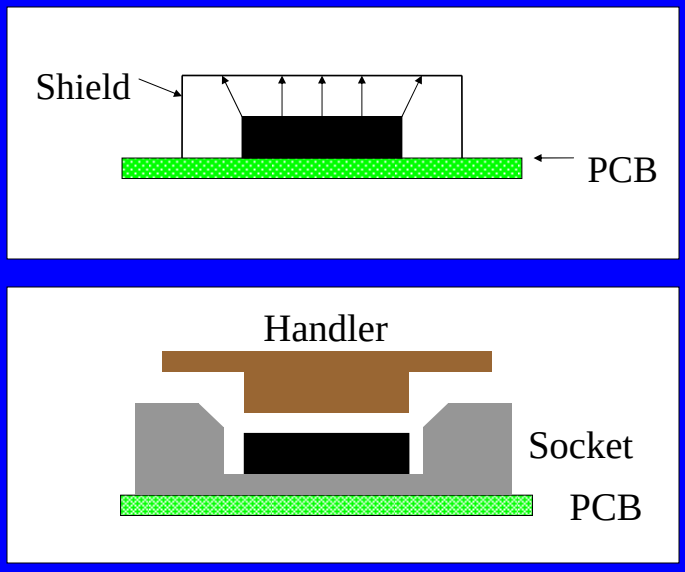
Application Versus Test Environment



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Summary

- Not possible to evaluate all contactors
- Know your value proposition
- Know your competition and what differentiates your product from the rest
- Have your contactor properly evaluated and data available
- Start thinking about systems to solve problems

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Thank You
Questions?

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Design Optimized, Manufacturing Limited – A 250W Thermal Solution

2008 Burn-in and Test Socket Workshop
March 9-12, 2008

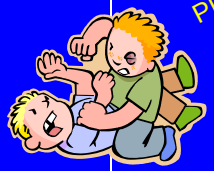
Trevor Moody
Kevin Hanson
Rick Davis

antares Advanced Test Technologies

HOW CAN A DESIGN MEET ALL REQUIREMENTS ?

Customer Requirements

- TECHNICAL SPECIFICATIONS
- LEAD TIME
- COST
- EASE OF USE



Internal Company Requirements

- PROFITABLE
- RESOURCES
- REDUCE COMPLEXITY
- MANUFACTURABILTY

LOW VOLUME MANUFACTURING

3/2008 Design Optimized, Manufacturing Limited - A 250W Thermal Solution 2

Paper #2

INTRODUCTION

- What The Customer Wants !
- System Overview
- Designing for Low Volume Manufacturing - Cold Plate
- Product Performance
- Did We Give The Customer What They Wanted ?
- Did We Satisfy Our Internal Company Requirements?

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What the Customer Wanted

- 250 Watt Processing Module
- Characterize From 0°C to 100°C
- Minimize Temperature Undershoot And Overshoot
- Customize The Solution To Their Current Hardware
- Must Be Mobile With A Small Footprint
- Closed System
- No Consumable Gases

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The Module

- High End / High Reliability Processing Module
- High power CPU
- Standard DUT Board
- Standard Tester Footprint

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SYSTEM COMPONENTS

Mechanical Actuator

Thermal Control Unit

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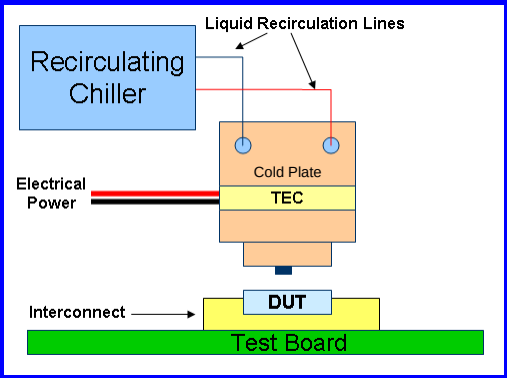
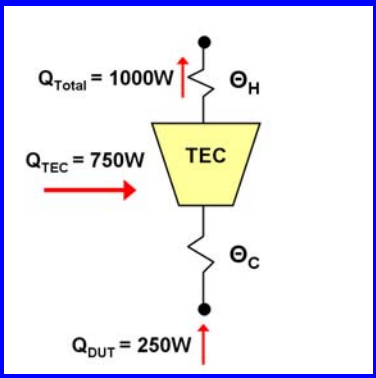
HOW DOES THE SYSTEM WORK





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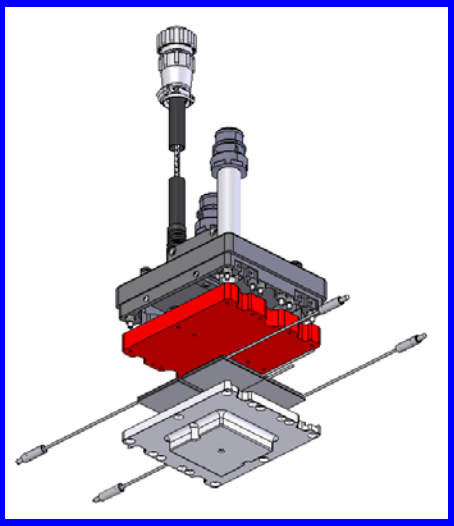
SYSTEM COMPONENTS

Thermal Control Unit



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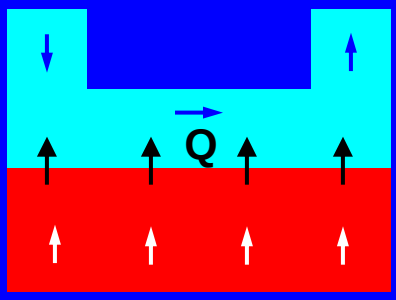
COLD PLATE

Exchanges heat from a solid to a fluid that are at different temperatures



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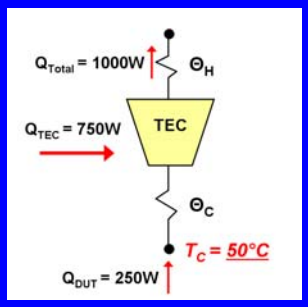
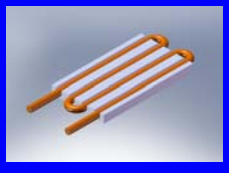
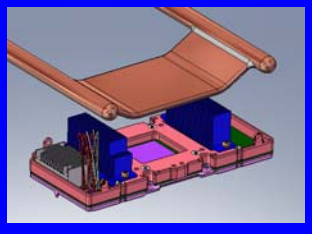
EXISTING TECHNOLOGY

Product that works within the size restraint



Product that satisfies the heat load requirements





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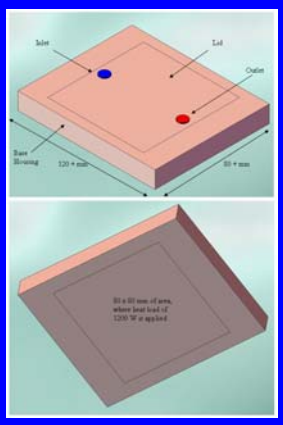
OUTSOURCE THE DESIGN

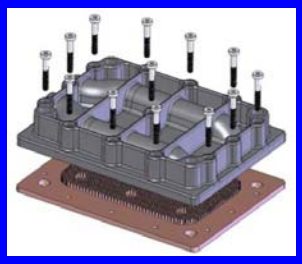
Form Factor &
Performance Requirements



NRE

Higher Per Piece
$ Price $

Output



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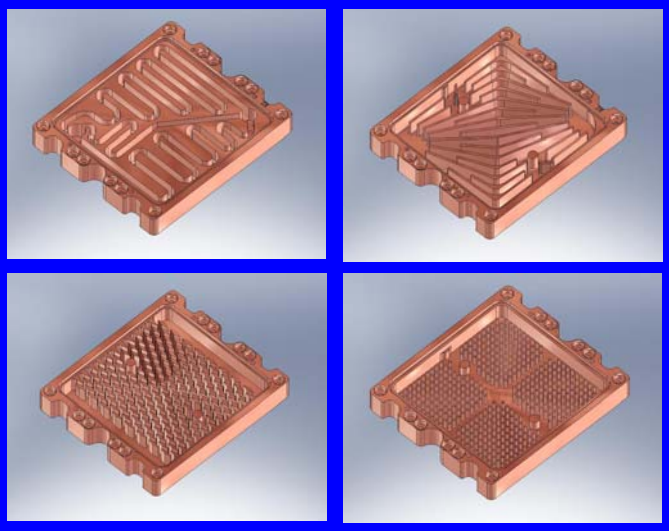
DESIGN FOR LOW VOLUME MANUFACTURING – COLD PLATE



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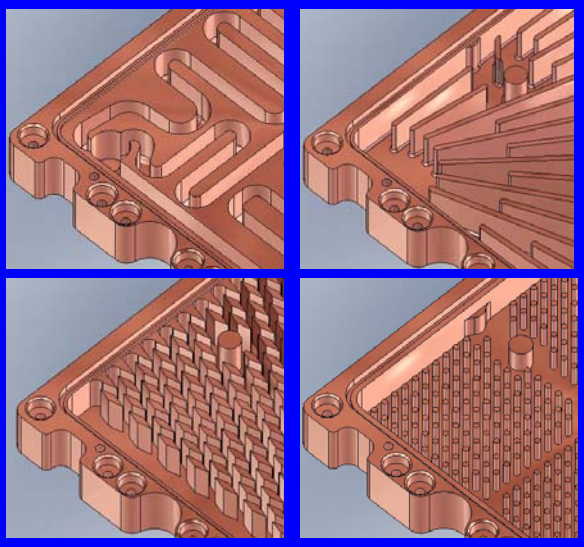

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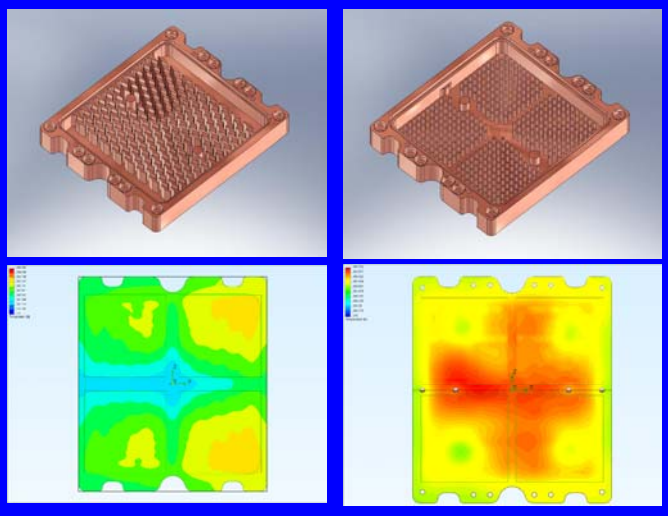

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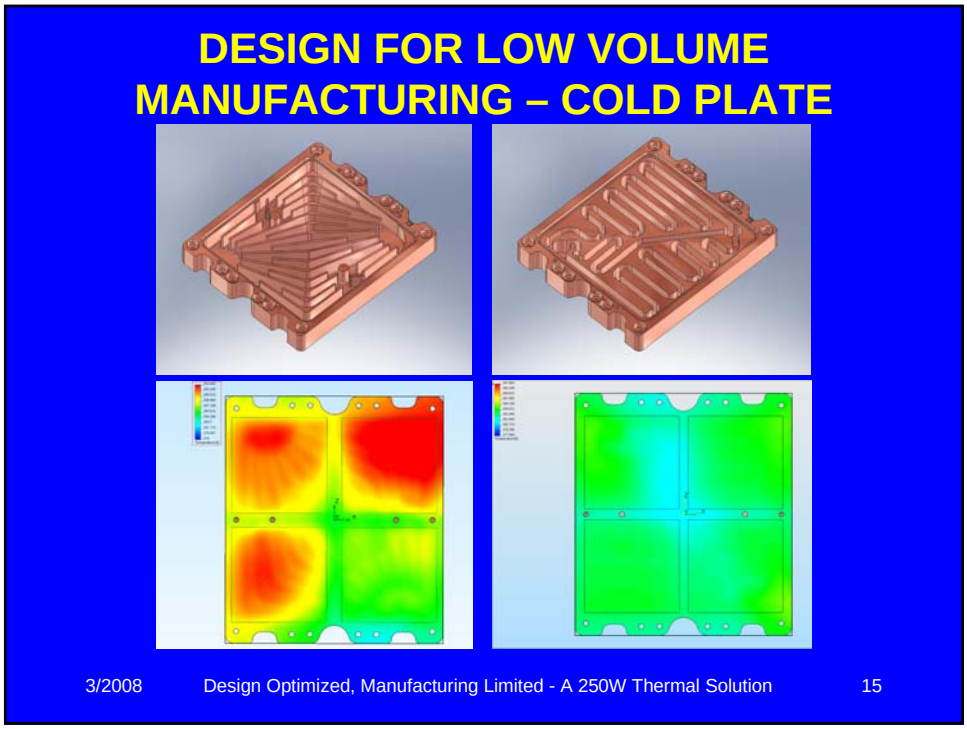
DESIGN FOR LOW VOLUME
MANUFACTURING – COLD PLATE
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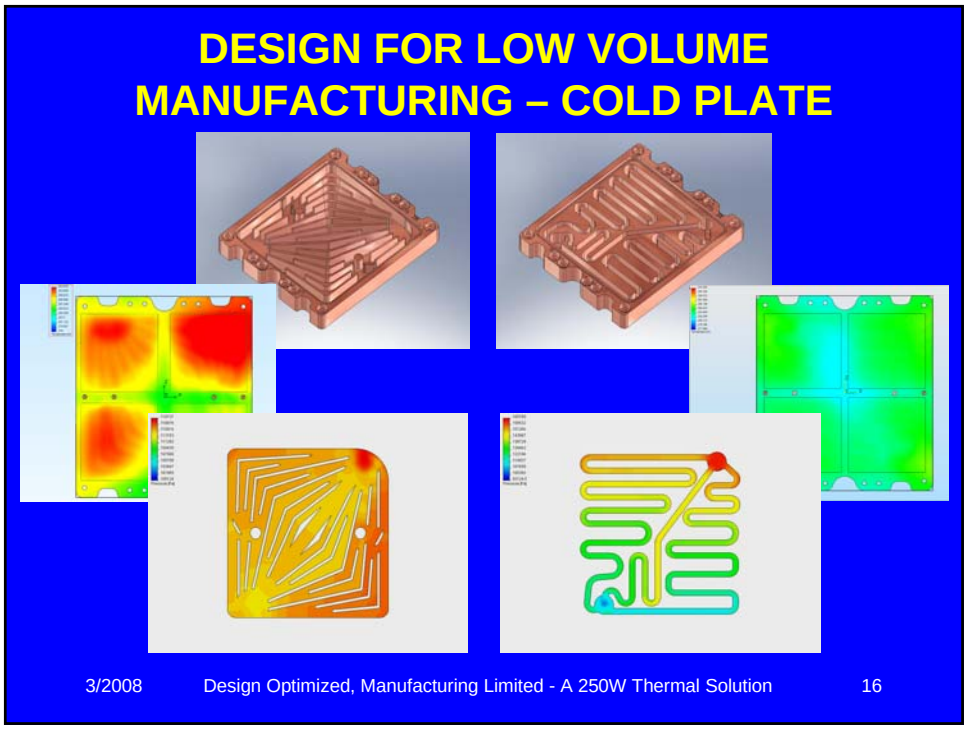
DESIGN FOR LOW VOLUME
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16

THE SOLUTION

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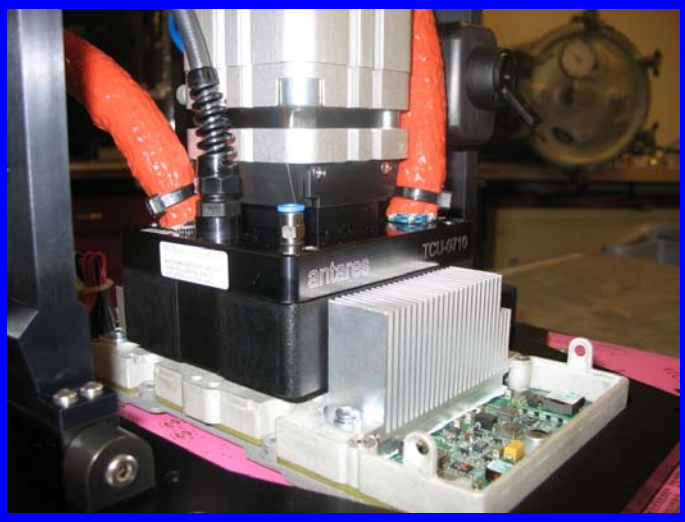
THE SOLUTION



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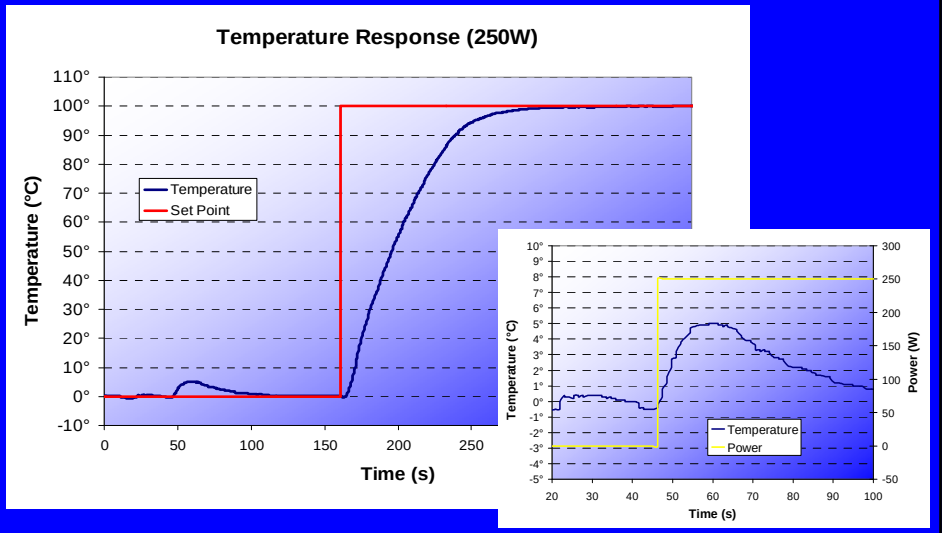
PERFORMANCE



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CONCLUSION

Did we give the customer what they wanted ?

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DID WE GIVE THE CUSTOMER WHAT THEY WANTED?

- ✓ REQUIEREMENTS
  - 250W Solution
- ✓ CUSTOMER SATISFACTION
  - ¼ Cost of Existing Solutions

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DID WE SATISFY OUR INTERNAL COMPANY REQUIREMENTS?

- ✓ Technical Requirements
- ✓ Customer Satisfaction
- ✓ Low Volume Manufacturing
  - Trade-Offs

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Test Socket Tracking: From Cradle to Grave

2008 Burn-in and Test Socket Workshop
March 9 - 12, 2008

Angelo Giaimo
IBM Corporation

HOW DO YOU KNOW ?

- In today's dynamic test mfg environment:
  - How do you know that the Front End Hardware that you just put on the tester is good?
  - How do you know that you won't be wasting precious tester time to figure it out?
  - Can you afford more Testers?
  - Want to lower the cost of test?

AGENDA

- Overview of GTS for Test and B/I HW Tracking.
- Need to improve previous FEH Quality and Performance Tracking.
- Solution: Implementation of new SARA Tool
  - HW Enhancements for Manufacturing
  - SW Enhancements for Manufacturing
- Summary
  - System Overhead
  - Return On Investment

March, 2008 Test Socket Tracking: From Cradle to Grave 3

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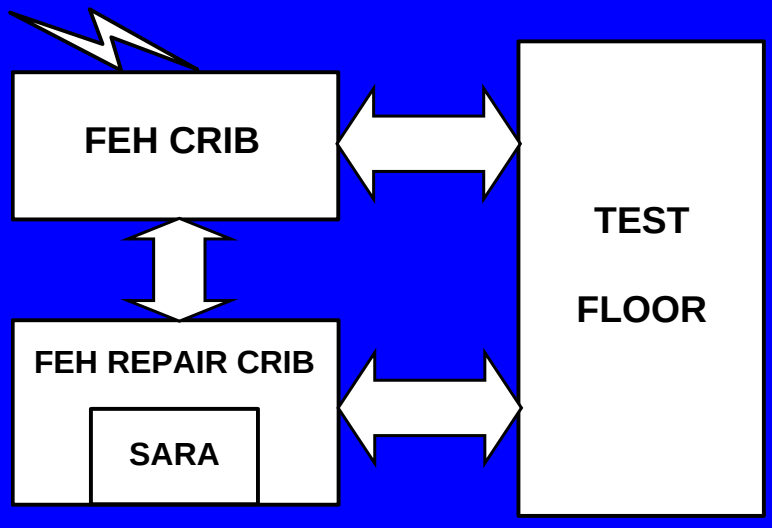
March, 2008 Test Socket Tracking: From Cradle to Grave 4

GTS: OVERVIEW

- Global Tracking System = Test Hardware Life Tracking System.
- DB2 Based with Web Access
- Tracks Inventory of all Test HW
- Matches Correct FEH to Job/Product being Run
  - Saves Operator, Maintenance & Tester Time.
  - Avoids Product Damage

March, 2008 Test Socket Tracking: From Cradle to Grave 5

GTS SOCKET TRACKING



March, 2008 Test Socket Tracking: From Cradle to Grave 6

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March, 2008 Test Socket Tracking: From Cradle to Grave 8

SARA: BACKGROUND

- SARA = Socket Analog Resistance Analyzer
- Metrology Tool used to make accurate mass measurements of Socket and Probe Assemblies.
  - Architected for 2,209 usable I/O's (47X47 Array)
  - Pseudo-4 Point Measurements (BiTS 2000 Paper)
- Originally designed as an Engineering Tool.
  - Lab/Development Environment
  - Used for the development, evaluation and test of Test and B/I Sockets.
- HW and SW upgrades for MFG use.

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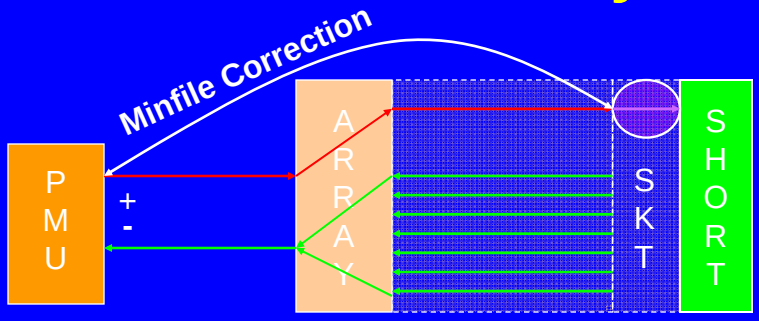
SARA HARDWARE: BURLINGTON, VT

March, 2008 Test Socket Tracking: From Cradle to Grave 10

SARA HARDWARE:
BROMONT, CANADA

March, 2008 Test Socket Tracking: From Cradle to Grave 11

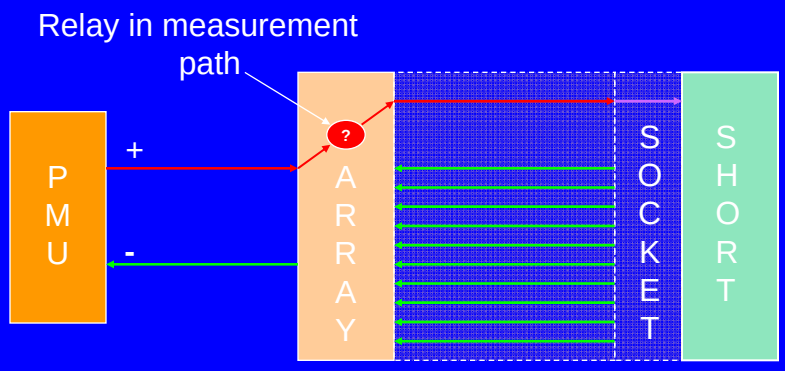
SARA HW: 2 Point System



- +PMU: Array selects pin to be tested.
- -PMU: Array selects all remaining pins.
- Minfile subtracts out system resistance
- High pincount return path => 0 Ohms
- Remaining loop resistance = Contact Resistance

March, 2008 Test Socket Tracking: From Cradle to Grave 12

SARA HW: 2 Point System



As Relays Age and/or Fail, Relay Contact Resistance values varied by over +/- 4 ohms, causing inaccuracies in the measurement system.

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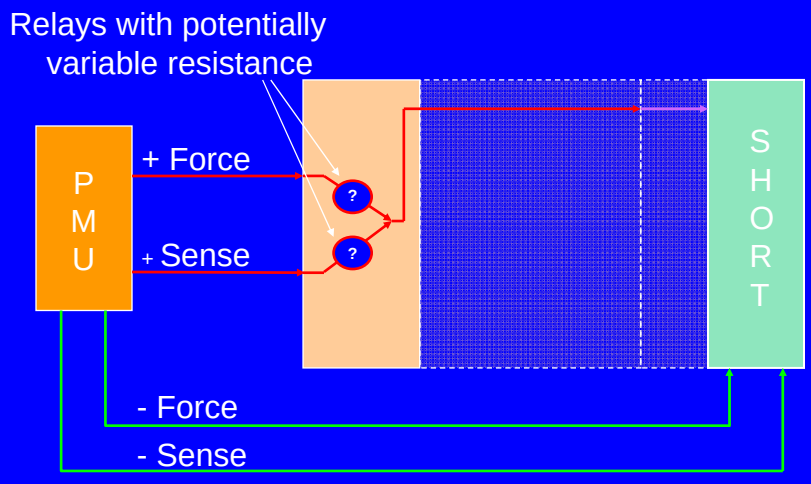
SARA HW: 4 Point System



Relay contact resistance removed from measurement path.

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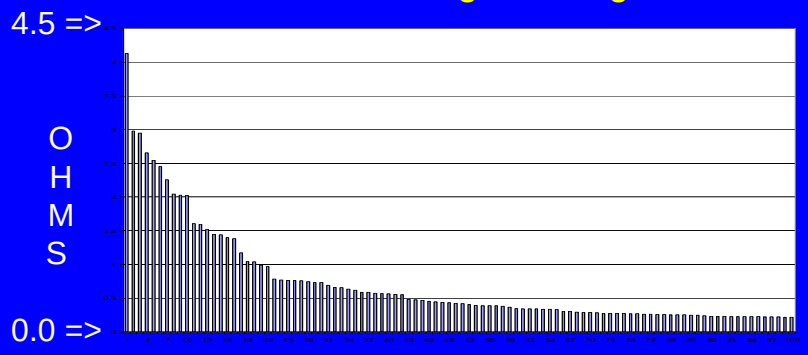
SARA REPEATABILITY: BEFORE

2 Point Measurement Range: 100 Highest Channels



Range = +/- 4.128 to +/- 0.216 Ohms

Spec is +/- 5 milliohms!!!

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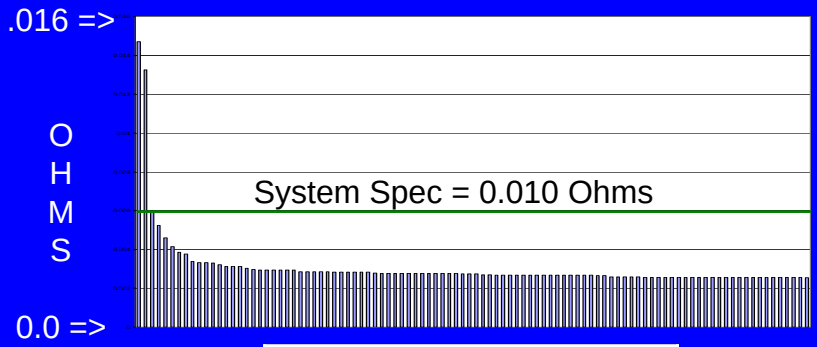
SARA REPEATABILITY: AFTER

4 Point Measurement Range: 100 Highest Channels



Ohms	Highest	100'th
2 pt	4.142	0.215
4 pt	0.016	0.00255

March, 2008 Test Socket Tracking: From Cradle to Grave 16

2 TO 4 POINT HW CONVERSION:

- TASKS:
  - Updated Relay Configuration
  - Update Test fixtures for Topside –Force/-Sense Contacts
    - Not ALL the sockets we test are ours….
    - Make provisions where we can't access top of Socket; BGA Socket Testing, etc.
  - Reprogram PMU to 4 point.
  - Create ALL new calibration files for every fixture combination currently in use!

March, 2008 Test Socket Tracking: From Cradle to Grave 17

SARA SOFTWARE

- Automated Test, Start to Finish…..
  - Operator just needs to scan socket barcode
  - Socket & Pass/Fail data
  - SARA Setup Parameters
  - Unique output filenames, Timestamped
  - Auto Socket Disposition for Operator:
    - OK, Repair or Repopulate.

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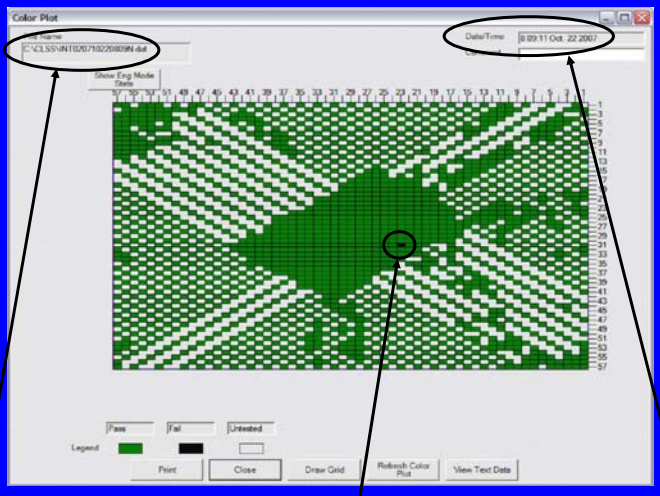
SARA SOFTWARE GUI

March, 2008 Test Socket Tracking: From Cradle to Grave 19

PASS/FAIL COLORMAP



March, 2008 Test Socket Tracking: From Cradle to Grave 20

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  - SW Enhancements for Manufacturing
- **Summary**
  - **System Overhead**
  - **Return on Investment**

March, 2008 Test Socket Tracking: From Cradle to Grave 21

SYSTEM OVERHEAD

- EVERY piece of FEH used must be uniquely barcoded for GTS
- Each item must be uniquely identified in lookup table and all test parameters defined. (Netlist, Test Fixture, Norm File, etc, etc.)
- Engineering to monitor/evaluate Process.

March, 2008 Test Socket Tracking: From Cradle to Grave 22

RETURN ON INVESTMENT

- Tester Utilization Savings
- Yield Loss reduction due to defective FEH
- Yield Loss reduction due to downbinning.
- Reduced Manufacturing Operator Labor
- Reduced Test Floor Maintenance Labor

March, 2008 Test Socket Tracking: From Cradle to Grave 23

FINAL COMMENTS

– GTS and an updated SARA tool has been proven to:
  - Accurately diagnose and aid in the repair of FEH
  - Aid to track pogo pin life.
  - A more efficient test floor and higher yielding product.
  - Socket MTBF and Preventive Socket Maintenance

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