NINETEENTH ANNUAL

BiTS

Burn-in & Test Strategies Workshop

March 4 - 7, 2018

Hilton Phoenix / Mesa Hotel
Mesa, Arizona

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Life Cycles of Sockets; Specification vs Reality and Setting Standards

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BiTS Workshop
March 4 - 7, 2018

Agenda

- End of Life Requirements
  - scenarios in Validation and Test
- Socket Evaluation Methodology
- Factory feedback
- Need Standards

End of Life Requirements

Validation Disciplines	Validation Coverage
Power Thermal and Performance Validation	Validates thermal design power (TDP), thermal sensor accuracy, thermal throttling algorithm and power delivery
Analog and electrical Validation	Validates electrical performance and IO design
Functional validation	Validates logical functionality of the device

Validation → Find Logical Bugs

Validation uses validation boards or reference boards

Socket and thermal system uses quick release retention designs or simple loading mechanisms

Socket EOL > 200 cycles

Test	Coverage
Burn-in	Accelerates latent defects to meet time zero reliability
Class	Continuity tests, power measurements, dynamic frequency/voltage, test of all logic, arrays, I/O testing and SKU calculations
Circuit Marginality Validation (CMV)	Validates the safety margins of circuits
System Level Validation (SLT)	Uses a product specific tester interface unit based on the reference motherboard SLT insures shipping quality parts and for measuring outgoing Quality
Quality and Reliability	Extended life test

Test → Transforms design into competitive products.

Test→ Remove the defects introduced by Si fabrication process

Class and SLT utilizes robotic handlers

Socket EOL > 500K cycles

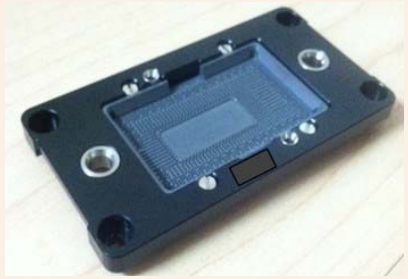
Socket Electrical, Mechanical, Thermal Performance, Lifecycle and Cost are critical vectors

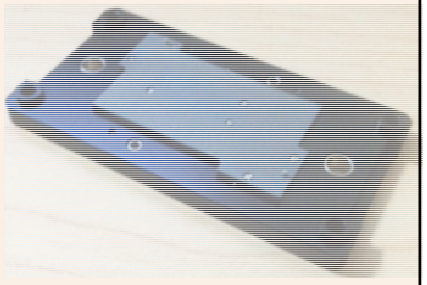
Additional Socket Evaluation Methodology

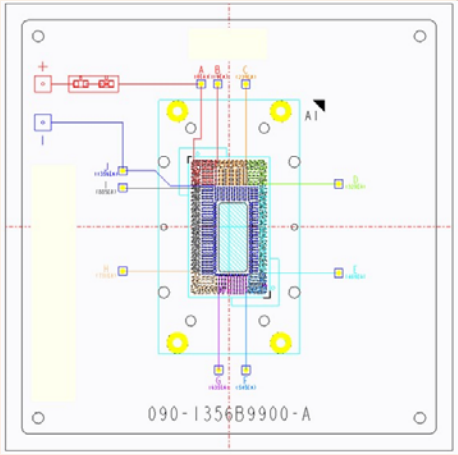
- Equipment
  - Tester/Handler with actual devices
  - Socket and test fixture
  - Cres measurement equipment
- Process
  - Maintenance Cleaning intervals
  - Insertion/extraction tracking
- Other
  - Evaluation are done per technology
  - Then done for every families
  - Per device, only tested for opens/shorts, mechanical fit check

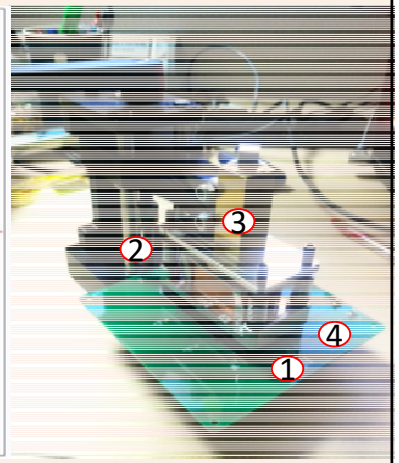
Socket Evaluation Methodology

- Electrical
  - Daisy Chained Test Boards are used to evaluate the force/pin and contact resistance per pin and variations between sockets of same or alternate technology
  - Insertion loss and return loss
- Mechanical
  - Force/pin, socket tip wear on the DUT side and PCB side, marks on the package
  - Checking for contamination on the pins under the microscope
- The socket is then run for 1000 mechanical cycles in the system level testing setup, then through actual system level testing.
  - Passed the short test and passed the long test content except for a specific content for 1000 cycles. Cres tests were repeated using the daisy chained test boards.
  - Similar exercise were done for 2000, 3000 and 5000 cycles. At 5000 cycles, failed short and long test content for SLT.



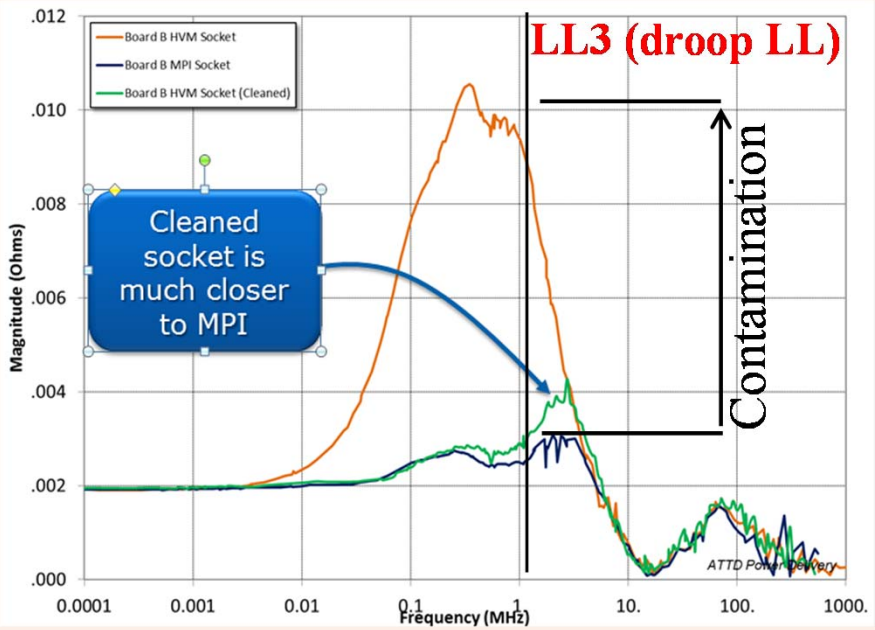




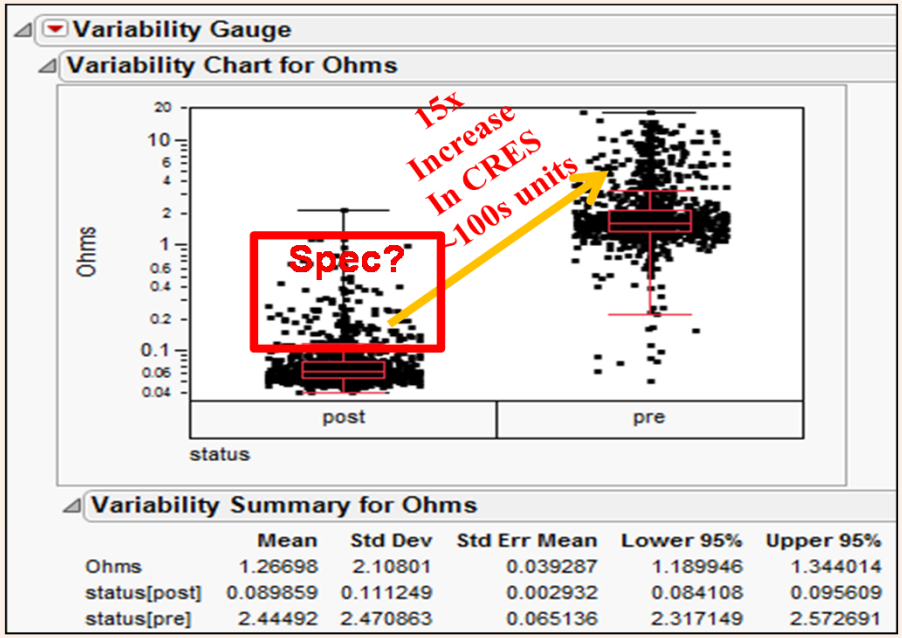


Clear disconnect between socket vendor data of 100K cycles vs > 3K and < 5K cycles

Factory Feedback



Impedance vs Frequency Measurements



	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Ohms	1.26698	2.10801	0.039287	1.189946	1.344014
status[post]	0.089859	0.111249	0.002932	0.084108	0.095609
status[pre]	2.44492	2.470863	0.065136	2.317149	2.572691

Contact Resistance between Pre and Post cleaning

Manual reject validation shows ~50% of the SLT rejected failures actually pass with the validation sockets → Direct impact on Yield

Need Standards

- What are the major influences on socket life?
  - Temperature cycling, power cycling, current carrying capability, how long the current is applied for, force distribution, electrical performance specially high speed data rates, package size, pitch, number of pins, routing of the signal, power and ground pins.
- How should life cycle be defined across the industry?
  - What is critical?
    - Socket Electrical, Mechanical, Thermal Performance, Lifecycle and Cost are critical vectors
    - Socket specs has to be defined for that socket rather than the technology itself. It's all the other interaction that actually determines the performance of the socket in the specific application
  - What is controversial?
    - Disconnect between the socketing technology and the whole socket performance itself
  - What is unnecessary?
    - One size fits all for the technology will not work