Burn-in & Test Socket Workshop

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Test Technology Technical Council
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Session 2
Monday 3/03/03 10:30AM

Burn-in Tools And Test Equipment

“DUT Host: DUT-Level Burn-In System Diagnostic Tool”
Trent W. Johnson - Advanced Micro Devices

“Total Automation Of Burn-In Process Flow”
S. Kumaran - Trio-Tech International

“Qualification Of Test And Burn-In Sockets Using A Desk Top Test System”
Jeff Cymerys - Advanced Micro Devices
Ken Hallmen - Checksum, Inc.
Rafiq Hussain - Advanced Micro Devices
Agenda

• The Hybrid Burn-In Platform
• Introduction to DUT-Host
• DUT-host Software structure
• Sample Screen Shots
• Summary of Lessons Learned
Hybrid Burn-In Overview

What Is “Hybrid Burn-in”?  

- New generation of burn-in technology at AMD that has evolved due to the unique requirements of the Athlon and Duron microprocessor product lines
  - More electrical features than “traditional” burn-in (minus ovens)
  - Individual DUT temperature, voltage, and frequency control
  - Able to execute X86 code and BIST code individually
  - Failed units can be shutdown individually to prevent damage
  - Real time individual data collection and communication to host

- “HBI” is actually a multiple position, independently programmed, low pin-count, tester that is able to economically run long test times (burn-in durations) at unique burn-in conditions

[Mark Miller - BiTS 2001]
Hybrid Burn-In Block Diagram

- 10 DUT positions controlled by one local microcontroller
- 18 Trays linked to the “Cell-host” via Ethernet
- Multiple Cell-hosts linked to the “Site-host” computer
- Production data accessed remotely from Site-Host
What is DUT-Host?

• DUT-Host is a tool developed by AMD to allow manual control over AMD’s Hybrid Burn-In system.

• DUT-Host provides a unique test environment for a single DUT in Hybrid Burn-In.

• DUT-Host is simple enough to use that an expert is not required to operate it.

• One Cell-host computer controls several DUTs.
The old way of debugging

Tedious C++ code

- Recompilation at every change
- No real-time feedback
- Must be an “expert” to make sense of it all
- The person who knows it ends up doing it for everybody
• Software may be added to Hybrid Burn-In as a plug-in

• DUT control via special C++ functions
Logic flow (function calling)

- Control System is in charge

- Windows© GUI takes all orders from the Control System thread

- DUT control efficiency is maintained in exchange for making the user wait a few more milli-seconds.
Shmoo requirement

• VLSI testers have a great tool called “Shmoo” that plots pass/fail status over voltage and frequency.

• A common option on Shmoo is to show a legend of the failing tests.

• Shmoo plots often show up speckled near failing boundaries. A manual re-test feature is necessary.

• What is a “Shmoo” anyway???
Shmoo Condition Selection

This is Shmoo
Voltage vs. Frequency Shmoo

- Fewer fail modes makes the output simple
- Double-click for re-test
- Failing boundaries are automatically tested twice.
Temperature as a shmoo axis

- Plot is NOT available with conventional VLSI testers
- Can seek out temperature dependent problems.
3-Dimensional failure plot

- We have control over Temperature, Voltage, and Frequency of the DUT
- Need a way of combining all 3 axes into a chart while retaining readability
- Solution: Use more color and data labels
3-Dimensional F-Max Shmoo

Temperature

Position: 0.0

Voltage
More Ways of Displaying Data

• For many custom experiments, Shmoo is not adequate

• Need a way to convert ALL HBI features into tunable knobs

• Need to see and log every possible traceable result

• Need to operate any or all DUTs at the same time

• Need it all in one dialog
Control Console

Inputs

Outputs
DUT-Host vs. VLSI Tester

DUT-Host on HBI

- Hundreds of dollars per position
- Basic JTAG Interface
- Simple to use
- Temperature control integrated
- Basic set of debug tools
- Inexpensive Signal drivers cannot operate very fast
- Slow test time

VLSI Tester

- Millions of dollars per position
- Hundreds of data channels
- High skill level required to use
- Temperature control is external
- Extensive set of debug tools
- Signal drivers can run at high speeds
- Fast test time
Lessons Learned

• **DUT-Host** has proved to be a useful tool for the following:
  – First Silicon check-out
  – Silicon Debug
  – Hardware diagnostics
  – Hardware development tool
  – Thermal cycling experiments

• **DUT-Host** still requires extra “hacking” to support device-specific test parameters.

• No matter how hard we try, we still need VLSI testers
Conclusion

• DUT-Host allows the potential of Hybrid Burn-in to be realized.

• No special training required to use DUT-Host.

• DUT-Host is a cost-effective alternative to a VLSI Tester for basic testing tasks.

• Burn-in Software Development is becoming an important task as we move to more complex burn-in systems.

• Testability: You get what you pay for.
Acknowledgements

Special thanks to Mark Miller for the use of presentation slides to describe Hybrid Burn-in in this presentation.

Hybrid Burn-In is the successful result of the combined efforts from numerous engineers at AMD.
2003 Burn-In & Test Socket Workshop

Total Automation of Burn-In Process Flow

S Kumaran (Engineering Manager)
Outline

✓ Objective
✓ System Overview
✓ Advantages
✓ Specifications
5) Automated Burn-In Process Flow
✓ Electrical Test Module (Bench Check Station)
✓ Lot Summary Report / database
✓ Upgrading, Cost & Quality Comparison
✓ Summary
✓ Video
1) Objective

To Innovate the automation of all Burn-In Processes, to raise yield and increase productivity. Following were automated to achieve the objective:-

- Dry cleaning of BIB
- Loading of empty Burn-In-Board (BIB) from trolley
- Loading devices into BIB
- 100% Bench Test of loaded BIB
- Transfer of BIB onto Oven trolley
- Loading of BIB into Oven for Burn-In
- Unloading BIB from oven and unloading devices
2) System Overview

- Burn-In Board Dry Cleaner
  The Module was developed to clean Burn-In Board in Trolley
b) Loader/Unloader module was developed to:

- Automatically load devices onto BIB
- Perform 100% device Testing at Board Check
- Loading BIB back onto Oven trolley
2) System Overview (Cont’)

c) Auto-BIB sloter into oven chamber & oven Trolley

This module was developed to automate loading and unloading of BIB in oven. Trolley lock onto oven for automatic loading and unloading of Burn-In Board from Oven.
3) Advantages

- Reduces the operating cost
- Increases device yield
- Minimise human error (eg. Bent leads)
- Maintaining lead integrity
- Perform precise and high-speed transfer of IC packages
- Dry cleaning minimises dust particle on device
- Pleasant working environment
Advantages (Cont’)

- User friendly buttons on both PC and machine
- Technicians easily trained to operate machine
- Software can be accessed/viewed/controlled from a remote PC
- Easy maintenance, with manual in help menu
4) Specifications

- Handles Package Type: All open top packages including PGA, BGA, QFP, TQFP, TSOP, SOP, SSOP & PLCC
- Resistance Check (0 ohms to 20 Mohm)
- Electrical Check: Signal Integrity Test (Max. 64 signal simultaneously)
- Results stored in database
- Automatic print-out of test result
- Throughput, 2200 UPH for 144pin QFP device, 2 head
5) Automated Burn-In Process Flow

- Empty BIB Dry Clean Machine
- Empty BIB is loaded into PnP Machine
- Loaded BIB is transported to 100% Board Check Station (BCS) module
- Device loading from tray to BIB
Automated Burn-In Process Flow (Cont’)

Position for 100% Electrical Board Check, with test pins automatically Brought down to BIB.

Trolley with BIB sloted automatically to Oven Chamber

Automatic 100% Bench Check Result display.

After signal test, loaded BIB will be transported back to the oven rack trolley
6) Electrical Test Module Flow

- Burn-In Specification set-up
- BIB to Bench Check Station (BCS)
- Resistance check
- Voltage and Signal Sequence-up
- Voltage/Current check
- Signal frequency/Vol/Voh check
- DUT output signal check
- Print test result
- BIBs stored in Pass/Fail section of trolley
100% Bench Check Station
Electrical Test Screen
7) Lot Summary Report/database

After testing of all BIBs from trolley:

- Test results (Lot Summary) stored in database
- Automatic print-out of test results at End of Testing the full Trolley
- It is sorted out
  - by the date and time of Automatic Bench Test
  - by the lot number
- Test results can be retrieved anytime from database
7) Lot Summary Report (Cont’)

Example
PnP5 : LOT Summary
Lot id : TTS173856-1
Operator id : 5898

Time : 13-03-02 --- 11:28:01
BIB tested : 48
BIB failed : 2
% passed : 96

[ BIB location ] : Socket number with failed Device___, <BIB Voltage>

[ 64 ] : 23___, 26___, <7.01V>
[ 63 ] : 0___, <0.03V>

End

Check by : ________________

Slot #

Vcc Voltage

0 indicate short or open cct bd
8) Upgrading, Cost & Quality Comparison

- IC Loaders upgradeable to include automated BIB 100% Bench check tester
- Oven upgradeable to include automated BIB loader/unloader
- Option to have BIB Cleaner incorporated
- IC loader/unloader, BCS, Stacker: USD 240,000
- Auto BIB oven loader/unloader: USD 35,000
- Automatic BIB Dry Cleaner: USD 80,000
- Return on Investment: 1.7 years
## 8) Upgrading Cost & Quality Comparison

### 8b) Comparison Table

<table>
<thead>
<tr>
<th>Manual Burn-In Process</th>
<th>Automated B/I Process</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bent leads due to human handling (80 ppm)</strong></td>
<td><strong>Minimize bent lead (20 ppm)</strong></td>
</tr>
<tr>
<td><strong>Handling Unit cost:- $0.0267</strong></td>
<td><strong>Handling Unit Cost:-$0.009</strong></td>
</tr>
<tr>
<td><strong>Throughput for 144ldQFP 510 device/per man hour</strong></td>
<td><strong>Throughput for 144ldQFP 2200 UPH</strong></td>
</tr>
<tr>
<td><strong>4 operators to achieve 2200 UPH</strong></td>
<td><strong>0.5 operator to achieve 2200 UPH.</strong></td>
</tr>
</tbody>
</table>
8) Upgrading Cost & Quality Comparison

8c) Dry cleaner’s yield before and after cleaning of BIB

<table>
<thead>
<tr>
<th>BD S/N</th>
<th>Particle Before Cleaning (&gt;100um)</th>
<th>Yield Before Cleaning</th>
<th>Particle After Cleaning (&gt;100um)</th>
<th>Yield After Cleaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>312</td>
<td>3</td>
<td>91.40%</td>
<td>1</td>
<td>94.80%</td>
</tr>
<tr>
<td>161</td>
<td>2</td>
<td>92.50%</td>
<td>0</td>
<td>95.30%</td>
</tr>
<tr>
<td>784</td>
<td>1</td>
<td>96.40%</td>
<td>0</td>
<td>96.90%</td>
</tr>
<tr>
<td>041</td>
<td>2</td>
<td>95.30%</td>
<td>0</td>
<td>97.40%</td>
</tr>
<tr>
<td>001</td>
<td>2</td>
<td>96.90%</td>
<td>0</td>
<td>99.00%</td>
</tr>
<tr>
<td>082</td>
<td>4</td>
<td>95.10%</td>
<td>0</td>
<td>98.40%</td>
</tr>
<tr>
<td>806</td>
<td>3</td>
<td>95.40%</td>
<td>1</td>
<td>96.30%</td>
</tr>
<tr>
<td>738</td>
<td>2</td>
<td>95.10%</td>
<td>0</td>
<td>95.70%</td>
</tr>
<tr>
<td>648</td>
<td>2</td>
<td>94.40%</td>
<td>0</td>
<td>95.60%</td>
</tr>
<tr>
<td>038</td>
<td>4</td>
<td>93.40%</td>
<td>1</td>
<td>95.30%</td>
</tr>
</tbody>
</table>

B/I Yield improved to 96.5% from 94.5%
9) Summary

In conclusion, with our 100% automation of Burn-In Process flow:

- Improve throughput by 4 times
- Cost Reduction
- Better quality output (Minimize bent leads)
- Minimise device damage, reduce attrition rate
- Better yield with lesser manpower
- Automate electrical test, results recording & printing
- Improve working environment
10) VIDEO

Dry Cleaner

PnP/ Tester

Auto-BIB Sloter
Into Oven Chamber
Qualification of Test and Burn-In Sockets Using a Desk Top Test System

2003 Burn-In and Test Socket Workshop
March 2 – 5, 2003

Ken Hallmen

BiTS

Jean Cymerys
Rafiq Hussain

CHECKSUM

AMD
Objective

- To qualify Open & Short performance of IC devices, test & burn-in Sockets

Plan of Record

- Test all contacts individually
- Socket lifetime
- Actuation force
- Contact resistance
- Real time testing
- User friendly desk top system
Agenda

• Why is real time testing important?
• Test System
  – Contact resistance testing
  – Digital IC package tests for opens & shorts
• Qualification of Test and Burn-In Sockets
• Post Assembly O/S testing of IC devices
• Conclusions
Real Time Testing

- Validation is done in a lab environment
  - Real time evaluation
  - System time is not an issue
- Sockets can be modified and tested immediately
- Bench Top System can be used in place of production tester
Opens/Shorts Test System

- Off-the-shelf plus customized load boards
- Expandable up to 8,000 channels
- Modular PC-based cards
- Requires very little space
- Stand-alone and/or integrated with a handler
- Simple programs with auto-learn
- Automated and manual program generation
- Specific failure diagnostics
Electrical Capability

- **Resistance**
  - $0\Omega$ to $19\text{M}\Omega$ (minimum to maximum)
  - Constant voltage
  - Constant current
    - Current ranges from $0.1\mu\text{A}$ to $10\text{mA}$ using $200\text{mV}$ or $2\text{V}$ compliance

- **Capacitance**
  - $1\text{pF}$ to $20,000\mu\text{F}$ (minimum to maximum)
  - $100$ Hz to $100$ KHz

- **Voltage measurement** for load board analysis
Contact Resistance Load Board

- Designed to isolate contact resistance
- Uses standard 4-wire Kelvin connections
- Measurement system zero offset compensation
- Milli-ohm resolution
- Milli-second measurements
4-Wire Kelvin Measurement

- Removes lead and trace resistance
- Requires proper physical layout for all traces
- Separate traces for current source
- Separate traces for voltage measurement
4-Wire Kelvin Connections

- 4-Wires connected to 4 separate test points
- Separate traces up to the socket
- Shorted IC test package
- Necessary for accurate, low-ohm measurements
- Up to 4,000 contacts using 4-wire connections
Digital IC Package Testing Load Board

- Contact resistance load board can be used
- Single connection to each lead is sufficient
- Verifies connectivity of I/O protection diodes
- Verifies common busses; e.g., VCC, VLDT, GND
- Milli-volt and milli-ohm resolution
- Milli-second measurements
IC Packaging Tests

- Tests connections from the BGA to die
- All common busses are checked for opens and shorts
- I/O protection diodes to busses verify I/O connections
Identification Recommendations

• Provide unique names for the test system I/O pins to identify failures quickly & accurately
  – Socket connection names, e.g. Pin 1, AE29
  – IC pin and signal names, e.g. Pin 1, AE29 MEMDATA[32]

• Socket connections names can be used for contact resistance tests
• IC pins and signal names can be used for IC packaging tests
Load Board Design Considerations

- Test system connections to the load board
  - Via cables to load board connectors
  - Via standardized interface from the tester to each load board

- Load board changeover efforts vary

- Can be configured with vacuum interface
Test System with Load Board
Standardized Load Board Interface

Load board on vacuum test head
Socket Qualification

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[Images of socket qualification components]
Socket Continuity

- Test each pin individually
  - Bus pins (VDD, VSS) tested for low resistance
  - I/O pins tested for connectivity (verify diode junction)
- Real time system response

“*” signifies out of range failures

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Type</th>
<th>Title</th>
<th>Low Limit</th>
<th>Upper Limit</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>A1</td>
<td>A2</td>
<td>Res</td>
<td>VDD Pin</td>
<td>0</td>
<td>5</td>
<td>3.25</td>
</tr>
<tr>
<td>R10</td>
<td>R7</td>
<td>Res</td>
<td>VDD Pin</td>
<td>0</td>
<td>5</td>
<td>5.2559 *</td>
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<tr>
<td>R10</td>
<td>Y14</td>
<td>Res</td>
<td>VDD Pin</td>
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<td>5</td>
<td>O_Rng  *</td>
</tr>
<tr>
<td>R10</td>
<td>N6</td>
<td>Res</td>
<td>VSS Pin</td>
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<td>5</td>
<td>4.6959</td>
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<td>M26</td>
<td>Res</td>
<td>VSS Pin</td>
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<tr>
<td>R10</td>
<td>J26</td>
<td>Res</td>
<td>VSS Pin</td>
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<tr>
<td>Signal Pin</td>
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<td>Res</td>
<td>MEM CLK</td>
<td>100</td>
<td>733</td>
<td>505.64</td>
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<td>Signal Pin</td>
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<td>Res</td>
<td>MEMVREF</td>
<td>100</td>
<td>733</td>
<td>826.12 *</td>
</tr>
<tr>
<td>Signal Pin</td>
<td>H25</td>
<td>Res</td>
<td>LO CAD OUT</td>
<td>100</td>
<td>733</td>
<td>O_Rng  *</td>
</tr>
</tbody>
</table>
Pogo Pin Actuation Force

- **Goal:** To determine the ideal contact force
  - Force on package
  - Force on die

- **Test Contactor or SLT (system-level test)**
- **Pneumatic actuator**
- **Force Measurement Unit**
  - Load transducer

- **Force vs. contact resistance**
Force Measurement Unit

- Pneumatic Actuator
- Device
- Socket
- Load Transducer
- Force applied (lbs)
# Force vs. Continuity (SLT)

<table>
<thead>
<tr>
<th>Force (lbs)</th>
<th>Force (g/pin)</th>
<th>ERRORS</th>
<th>Pass/Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.1</td>
<td>12.69</td>
<td>6</td>
<td>FAIL</td>
</tr>
<tr>
<td>22.2</td>
<td>13.36</td>
<td>18</td>
<td>FAIL</td>
</tr>
<tr>
<td>24.3</td>
<td>14.62</td>
<td>2</td>
<td>FAIL</td>
</tr>
<tr>
<td>26.4</td>
<td>15.88</td>
<td>1</td>
<td>PASS</td>
</tr>
<tr>
<td>26.5</td>
<td>15.94</td>
<td>0</td>
<td>PASS</td>
</tr>
<tr>
<td>27.4</td>
<td>16.48</td>
<td>0</td>
<td>PASS</td>
</tr>
<tr>
<td>28.5</td>
<td>17.15</td>
<td>0</td>
<td>PASS</td>
</tr>
<tr>
<td>28.7</td>
<td>17.27</td>
<td>0</td>
<td>PASS</td>
</tr>
<tr>
<td>29.5</td>
<td>17.75</td>
<td>0</td>
<td>PASS</td>
</tr>
</tbody>
</table>

- Identify the actuation force needed for all pins to make contact
- Goal: to achieve the lowest possible force!
- Consistency

**Zero Failures!!**
Pogo Pin Socket Lifetime (SLT)

- Insertion program
- Measurements at 25 k intervals
  - Goal is ~100 k insertions for SLT socket lifetime
  - 1 million insertions for test contactor

- Compare changes in contact resistance due to mechanical and thermal cycles
- Achieve mechanical lifetime of socket
  - Simulate production environment

- High frequency test – done separately
Mechanical Lifetime of socket

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Insertions</th>
<th>$R_{ave}$ (ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vendor A</td>
<td>Low</td>
<td>23.11</td>
</tr>
<tr>
<td></td>
<td>25 k</td>
<td>23.27</td>
</tr>
<tr>
<td></td>
<td>50 k</td>
<td>22.93</td>
</tr>
<tr>
<td></td>
<td>75 k</td>
<td>22.68</td>
</tr>
<tr>
<td>Vendor B</td>
<td>Low</td>
<td>22.82</td>
</tr>
<tr>
<td></td>
<td>40 k</td>
<td>22.04</td>
</tr>
<tr>
<td></td>
<td>80 k</td>
<td>22.16</td>
</tr>
<tr>
<td>Vendor C</td>
<td>Low</td>
<td>23.37</td>
</tr>
<tr>
<td></td>
<td>25 k</td>
<td>22.75</td>
</tr>
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<td></td>
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</tr>
<tr>
<td></td>
<td>75 k</td>
<td>22.57</td>
</tr>
<tr>
<td>Vendor D</td>
<td>Low</td>
<td>22.02</td>
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<tr>
<td></td>
<td>25 k</td>
<td>22.04</td>
</tr>
<tr>
<td></td>
<td>50 k</td>
<td>22.25</td>
</tr>
<tr>
<td></td>
<td>75 k</td>
<td>22.47</td>
</tr>
</tbody>
</table>

- Resistance values taken across a 20 ohm resistor in a package die

No increase in resistance

Slight Resistance increase
Bake and Contact Resistance (SLT)

- Does the contact resistance change after baking the socket?
- 48 hours bake at 90°C
- Repeatable for Burn-In socket evaluation
  - Higher temp
  - Longer burn-in cycles

### Resistance

<table>
<thead>
<tr>
<th>0 Hrs Bake</th>
<th>48 Hrs Bake @ 90°C</th>
<th>Change in milli-ohms</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.495</td>
<td>3.488</td>
<td>7</td>
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<tr>
<td>3.582</td>
<td>3.554</td>
<td>29</td>
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<tr>
<td>3.322</td>
<td>3.291</td>
<td>31</td>
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<tr>
<td>3.195</td>
<td>3.171</td>
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<tr>
<td>3.173</td>
<td>3.147</td>
<td>26</td>
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<tr>
<td>3.846</td>
<td>3.811</td>
<td>36</td>
</tr>
<tr>
<td>3.623</td>
<td>3.592</td>
<td>31</td>
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<tr>
<td>3.720</td>
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<td>-18</td>
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<td>3.185</td>
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<tr>
<td>3.279</td>
<td>3.276</td>
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### System-Level Test vs. End User Socket

<table>
<thead>
<tr>
<th>Package Pin</th>
<th>END USER</th>
<th>SLT 1</th>
<th>SLT 2</th>
<th>SLT 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDD ave (Ω)</td>
<td>1.823</td>
<td>2.973</td>
<td>3.046</td>
<td>3.138</td>
</tr>
<tr>
<td>VDDIO ave (Ω)</td>
<td>1.531</td>
<td>3.140</td>
<td>3.257</td>
<td>3.261</td>
</tr>
<tr>
<td>VLDT ave (Ω)</td>
<td>2.029</td>
<td>4.149</td>
<td>4.198</td>
<td>4.344</td>
</tr>
<tr>
<td>VTT ave (Ω)</td>
<td>2.624</td>
<td>2.927</td>
<td>2.989</td>
<td>3.358</td>
</tr>
<tr>
<td>VSS ave (Ω)</td>
<td>1.730</td>
<td>4.274</td>
<td>4.331</td>
<td>4.438</td>
</tr>
</tbody>
</table>

- Resistance values taken with a functional device loaded in socket.
Socket Type Comparison

- End user (OEM)
- Burn-In
- SLT
- Can we bring all socket platforms to the same contact resistance standard?

<table>
<thead>
<tr>
<th></th>
<th>Resistance (Ω)</th>
</tr>
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<tbody>
<tr>
<td>END USER</td>
<td>BURN-IN</td>
</tr>
<tr>
<td>2.1692</td>
<td>2.4028</td>
</tr>
<tr>
<td>2.1167</td>
<td>2.379</td>
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<tr>
<td>1.8015</td>
<td>2.0459</td>
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<tr>
<td>1.7888</td>
<td>2.0392</td>
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<tr>
<td>1.8163</td>
<td>2.0369</td>
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<td>1.8638</td>
<td>2.0796</td>
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<tr>
<td>2.168</td>
<td>2.3766</td>
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<tr>
<td>1.6496</td>
<td>1.9452</td>
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<td>1.6097</td>
<td>1.7743</td>
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<td>1.6481</td>
<td>1.8269</td>
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<tr>
<td>1.8512</td>
<td>2.0444</td>
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<td>1.8249</td>
<td>2.1837</td>
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<td>2.1094</td>
<td>2.2739</td>
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<td>2.0587</td>
<td>2.2256</td>
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<tr>
<td>1.6658</td>
<td>1.8267</td>
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<td>1.8736</td>
<td>1.9868</td>
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<td>1.934</td>
<td>2.0401</td>
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<td>1.8011</td>
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<td>1.9489</td>
<td>2.0633</td>
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<tr>
<td>1.2142</td>
<td>1.2738</td>
</tr>
</tbody>
</table>
Post Assembly O/S Testing

- No need for a fully functional tester
  - Limited tester time

- Test All Device pins
  - Signal & Source

- C4 Bump continuity
- Die Attach
- Handler capability for volume testing
- Validated and correlated to a functional tester
Conclusions

• Lab environment test solutions provide flexibility and real time capability
• Testing all device pins allows us to isolate socket, board design or assembly related problems
• Socket qualification is more effective and thorough.
• Time cycle from engineering prototype to production is reduced
Conclusions Continued

• Compare socket performance across all platforms
• Build volume quantities of sockets based on the validation of a few.
• Target the ideal actuation force
  - Alleviate stress on package
• Transfer a “plug-and-play” socket from an engineering environment to the production floor
Acknowledgements

Thanks to AMD sites at Singapore, Penang and Austin (product & manufacturing engineering)

Thanks also to Paul Baldock of Checksum Inc. and all our socket suppliers.
Questions?