Test Quality Assessment
I Need A Test For This Board!

- What can be tested?
- What WILL be tested?
- How will it be tested?
- How do I quantify the test quality?
A “Good” Test

- **Meets your test objectives** with the fewest number of measurements possible

- Does not necessarily need to make every possible measurement
“I know that you believe you understand what you think I said, but I'm not sure you realize that what you heard is not what I meant.”

Robert McCloskey
Specification – Statement of Work

• Standard Test Practices
  – Unpowered Tests.
  – Powered Tests.

• Custom Tests and Device Programming

• Fixture Configuration

• Acceptance Criteria
Acceptance Criteria

• How do you know if you specified a good test?
  – High yield at functional test?
  – Few field failures?

• How do you know you received what you specified?
  – Multiple PASS indications for the golden board?
  – High yield on prototypes or first production run?
Evaluate The Test

1. Look at the test coverage number.
Test Coverage:
What can be tested vs. what will be tested

Consider a board with 97 testable and 3 non-testable components:

- If 97 components are tested, is that 97% coverage or 100% coverage?
- If a test tolerance is ten times the part tolerance, the part has coverage, but is it really tested?
- How do I know from a coverage number if tests are effective at finding faults?
Evaluate The Test

1. Look at the test coverage number.
2. Examine the test plan.
Test Execution: What tests are actually run?

In the testplan:

- test “analog/c23”
- test “analog/r1”
- test “analog/r2”

In the test:

- connect s to nodes “A”
- connect i to nodes “B”
- resistor 10k, 10.2, 10.3, re3, ar100m
- !DUT: R1 test

In the testorder:

- test “analog/c23”
- skip “analog/r1”
- test “analog/r2”
Evaluate The Test

1. Look at the test coverage number.
2. Examine the testplan.
3. Look at the grading report.
**Test Grading Report:**

What is the CpK?

Number of test runs (in config.bdg): 10
Number of tests: 98

Report Flags:
- **F** = Test failed
- **M** = Mean not centered 66.67%
- **C** = Coefficient of producibility too small 10.00

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<th>Designator</th>
<th>Programmed</th>
<th>Computed</th>
<th># Flg</th>
<th>Com</th>
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Evaluate The Test

1. Look at the test coverage number.
2. Examine the test plan.
3. Look at the grading report.
4. Audit the Test Program.
General Audit Tactics

- Determine which components:
  - have a running test
  - have their tests disabled
  - do not have a test

- Grade the effectivity of running tests
  - Examine test tolerances
  - Determine “pin-activity”

- Analyze Results
  - Examine ineffective and non-running tests
  - Determine test criticality
Analyze Results
Unpowered Tests

- CPk tends to increase as test tolerances increase

- Test effectivity decreases as test tolerances increase

- Lower effectivity is acceptable for non-critical components
Analyze Results
Vectorless Tests

- Vectorless test detects only solder defects

- Alone, test effectivity can never be 100%

- Vectorless test can supplement library or boundary scan testing to increase overall device test effectivity
Analyze Results
Powered Tests

- Cause & Effect analysis may be impossible
- Examine each output for a measureable signal or a state change
- Examine each input for a stimulus
- Test effectivity increases more for each additional output measured than for each additional input stimulated
Analyze Results
Boundary Scan Tests

• Connect tests can be analyzed for input and output transitions, but every input affects an output – TDO

• Interconnect and buswire tests are written to work together to test all states on all boundary-scan device pins on each tested node

• Connect, interconnect, and/or buswire coverage can supplement library test coverage to increase the effective test quality of a powered device

• Powered shorts can supplement the unpowered shorts test to increase the effective quality of shorts testing
Conclusions

• Effective tests are a balance of:
  – test speed
  – test accuracy
  – test tolerance
  – test stability

• There is no absolute standard to gauge the effectivity of a device test.

• Device test effectivity analysis is “relative”.

• Ineffective tests are better than no test at all – ONLY if you know they are ineffective!
Summary

- Develop test programs in accordance with a set of requirements.
- Determine the test coverage.
- Determine the test stability.
- Determine the test effectivity and improve it where appropriate.
Questions?