ANSYS Sherlock—Reliability Physics in Your Design Process

/ Standard Hardware Design Process

1. Hardware Specs
   - Functional Block
   - Housing
   - Connectors

   Identifies stages where Sherlock should be implemented

2. Initial Part Selection (Critical components)
   - When designing functional block diagram, identify critical parts
   - Determine which Sherlock analysis to perform
   - Benchmark Sherlock analysis to existing data (test, field, etc.)
   - Re-run Sherlock analysis based on environmental requirements

3. Initial Part Placement (Pre-layout!)
   - Perform part-level Sherlock analysis with temperatures from Icepak thermal analysis
   - Place parts based on risk of failure due to vibration, mechanical shock, thermal cycling, and bending

4. Final BOM
   - Run Sherlock analysis on piece parts (discretes, passives)
   - Identify problem parts before test
   - More valuable than a simple derating table

5. Final Layout
   - Perform Sherlock analysis with all design features
   - Perform optimization studies
   - Risk of failure? Identify mitigations before test

/ Minor Alterations to Your Current Design Process

1. Enhances your current design process
2. Seamlessly integrates with already occurring simulation
3. Prevents costly “test-fail-fix-repeat” cycle

Sherlock Automated Design Analysis™ Software is the only Reliability Physics-based electronics design tool that provides fast and accurate reliability predictions in early design stages

/ Manufacturability

- Evaluate all post-assembly manufacturing processes
- Establish load limits to prevent solder fracture, pad cratering, and component cracking
Decide which ‘Critical Components’ should be subjected to RPA?

Within an analog/digital circuit, the critical components is almost always an integrated circuit.

**Option 1:**
- All ‘Critical Components’
  - Relatively few critical components (5 to 20) in most systems
  - Financially painful if components need to be replaced

**Option 2:**
- Critical Components most likely to fail
  - Integrated circuits have three to four different reliability risks
    - Aging/Wearout of Silicon Transistors (EM, TDDB, HCI, NBTI)
    - Cracking of Low-K Dielectric
    - Radiation-Induced Failures of Silicon Transistors (SEU, TIO)
    - Solder Fatigue of the Semiconductor Packaging (Thermal Cycling, Vibration)
  - Evaluate critical components based on their susceptibility to these risks

Decide Which RPA to Run:

- Aging/Wearout of Silicon Transistors (EM, TDDB, HCI, NBTI)
- Cracking of Low-K Dielectric
- Radiation-Induced Failures of Silicon Transistors (SEU, TIO)
- Solder Fatigue of the Semiconductor Packaging (Thermal Cycling, Vibration)

Acquire Selected Part Test Data and Benchmark to Test Data

**Option 1:**
- If simulation does not match, test data, discuss with supplier
- After benchmarking to test data, model components to environmental conditions
- Accept/Reject/Bin the part