


# “Will structural test be relevant in 5-10 years?”

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Structural test will still be relevant,  
and (depending on how you define  
it) it may encompass more areas  
than it does today....

# Structural Test needs to address new realities

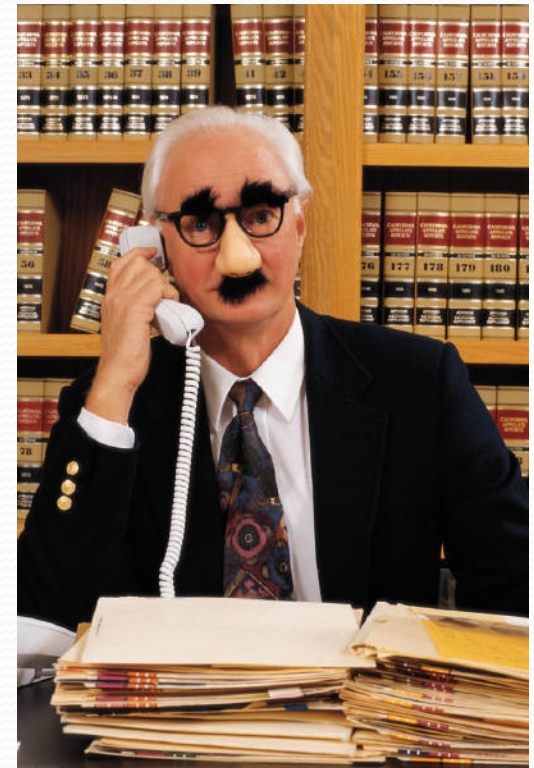
- Within chips, structural tests may need to be optimized with more functional information.
  - Quality
  - Debug
  - Test Time Reduction
- Structural tests need to be expanded to new areas
  - Analog structural test will become important
  - Need an analog fault model, structural analog tests, and a way of automatically generating them and calculating coverage.
  - P1687 networks will be used inside of ADCs, DACs, and other analog-ish devices

# Structural Test will be needed for security as well

- Fractured supply chain has led to significant concerns about counterfeiting.
  - Between 2007 and 2010 over **5.6 million** counterfeit semiconductor devices were seized by U.S. Customs and Border Patrol (CBP) and ICE (Immigrations and Custom Enforcement)
  - **IHS iSuppli** estimates that the total reported incidents for counterfeit parts is approximately **12 million** over the last 5 to 6 years. This averages to one counterfeit part found every 15 seconds.
  - In 2009, a NASA probe project was delayed nine months and went 20% over-budget due partly to counterfeit parts.
  - Entire NEC product line was counterfeited in across multiple factories in China and Taiwan
  - Display unit manufactured by L-3 Communications that provides the pilot with information regarding fuel use, engine status, and warnings was found to contain a chip that had a 27% increase in failure rates. Over 400 assemblies were affected.
  - U.S. DoD is shifting liability to military contractors for counterfeit parts that get placed in their boards.

# Types of counterfeits

- Reverse engineer, design, and manufacture chips to be functionally similar to the original
- Salvage old chips from boards and sell them as new chips
- Re-label low-performing die as high-performing
- Sell defective parts as working chips



# Structural tests and test access mechanisms can help detect counterfeits

- Access Chip ID's and physically unclonable functions (PUFs) on the test access network (such as through P1687) so that data can be compared to secure database
- On-chip sensors can be used to detect aging
- Structural test may be used with functional test (or pseudo-functional test) to help verify performance
- Environment under which querying of chips is done will be important
  - PUFs & aging sensors can be sensitive to temperature and voltage variations
- Counterfeit analysis should be done on field returns before detailed debug

# 3D and 2.5D Stacked IC's will require structural test

- Board Test will achieve a new level of complexity when 3D chips begin populating sockets and for several reasons:
  - In some architectures, board test people will need to verify the interconnect inside of chips (for example memory interconnect)
  - Board/system test people may need to use embedded instruments (for example High-Speed IO signal verification)
  - Board/system test people may need to use fault-tolerance (FPGA die, redundant logic, redundant memory elements) This may require debug and diagnosis capabilities that depend on structural test.
  - Board/system test people may need to configure the chip for test or use.



# Conclusions

- Structural Test and Structural Test Access Mechanisms will still be needed in in 10 years
  - Needs to be expanded to additional areas, especially analog.
  - Necessary to test, debug, and repair 3D stacks
  - Needed to help a) protect against counterfeit boards and b) discover that boards are counterfeit (or contain counterfeit components) when they show up as field returns.