SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

16EC303–VLSI DESIGN

III YEAR/ V SEMESTER

UNIT 4 –VLSI TESTING

TOPIC 5: Design Strategies -BIST & BOUNDARY SCAN

OUTLINE

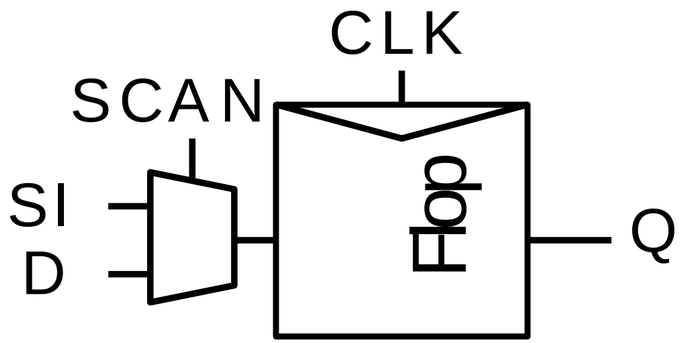
- Design for Test
  - Scan-FLIPFLOP
  - BIST
  - PRSG
  - BILBO

  Activity
- Boundary Scan
  - Examples
  - Interface

  summary

DESIGN FOR TEST

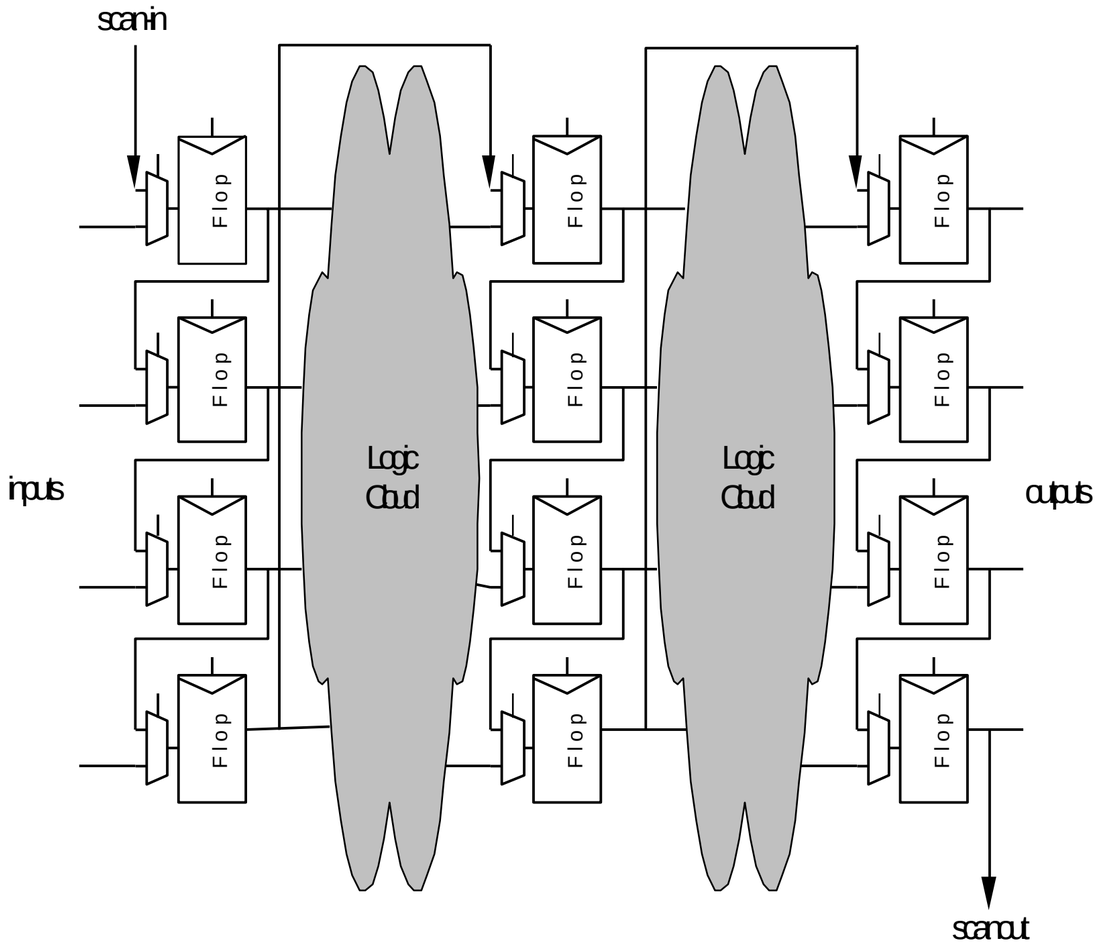
- Design the chip to increase observability and controllability
- If each register could be observed and controlled, test problem reduces to testing combinational logic between registers.
- Better yet, logic blocks could enter test mode where they generate test patterns and report the results automatically.



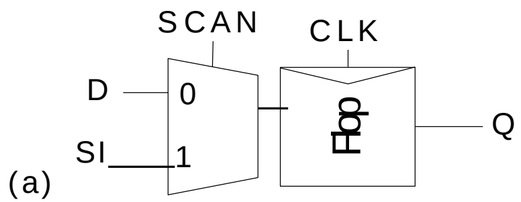
SCAN

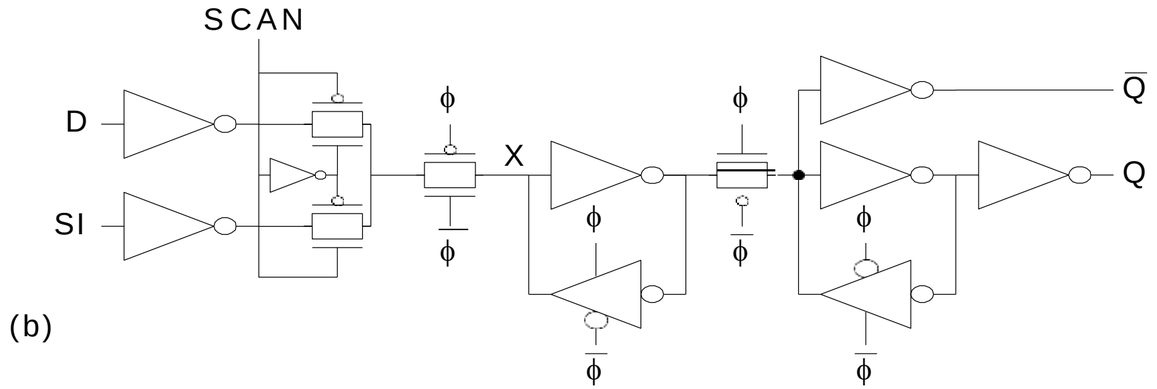
- Convert each flip-flop to a scan register
  - Only costs one extra multiplexer
- Normal mode: flip-flops behave as usual
- Scan mode: shift register
- Contents of flops

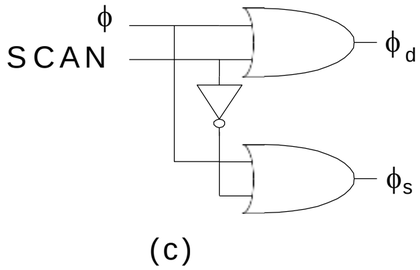
  can be scanned out and new values scanned in

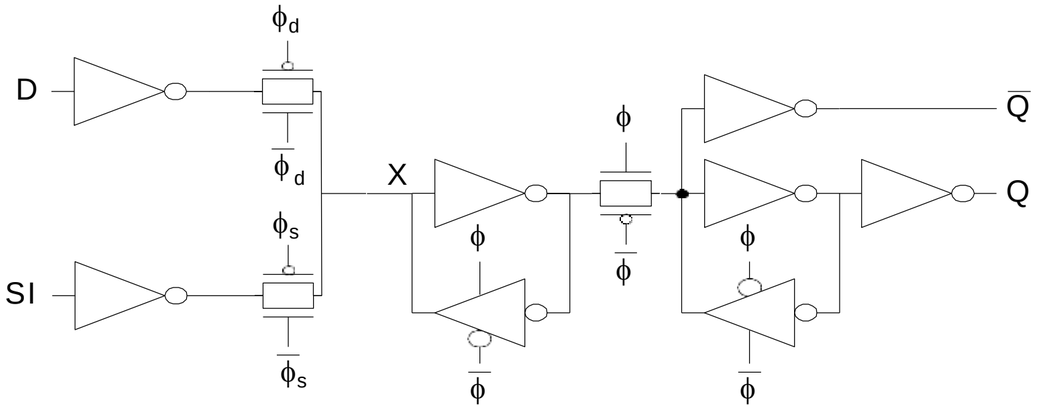


SCANNABLE FLIP-FLOPS





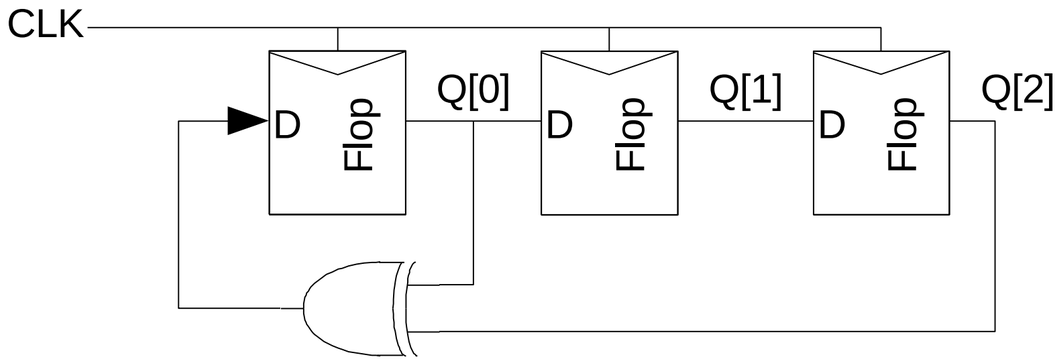




BUILT-IN SELF-TEST

Built-in self-test lets blocks test themselves

Generate pseudo-random inputs to comb. Logic. Combine outputs into a syndrome With high probability, block is fault-free if it produces the expected syndrome.



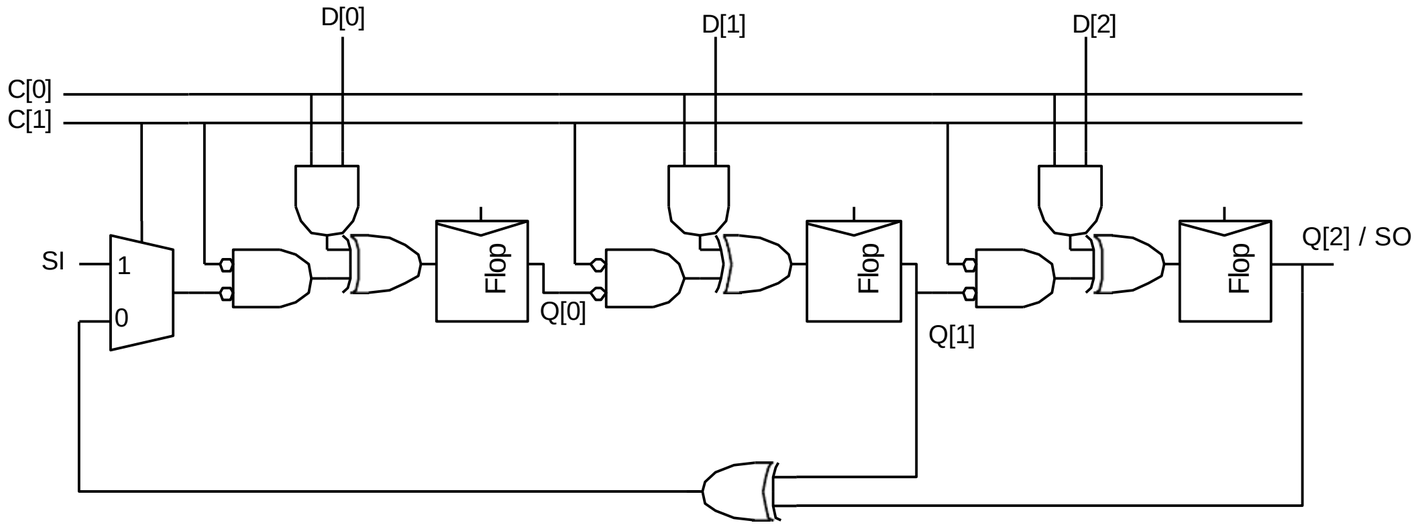
PRSG

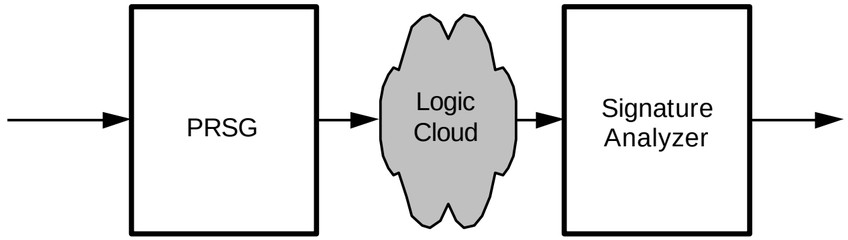
- Linear Feedback Shift Register
  - Shift register with input taken from XOR of state
  - Pseudo-Random Sequence Generator

Step	Q
0	111
1	110
2	101
3	010
4	100
5	001
6	011
7	111 (repeats)

BILBO

- Built-in Logic Block Observer
  - Combine scan with PRSG & signature analysis





MODE	C[1]	C[0]
Scan	0	0
Test	0	1
Reset	1	0
Normal	1	1

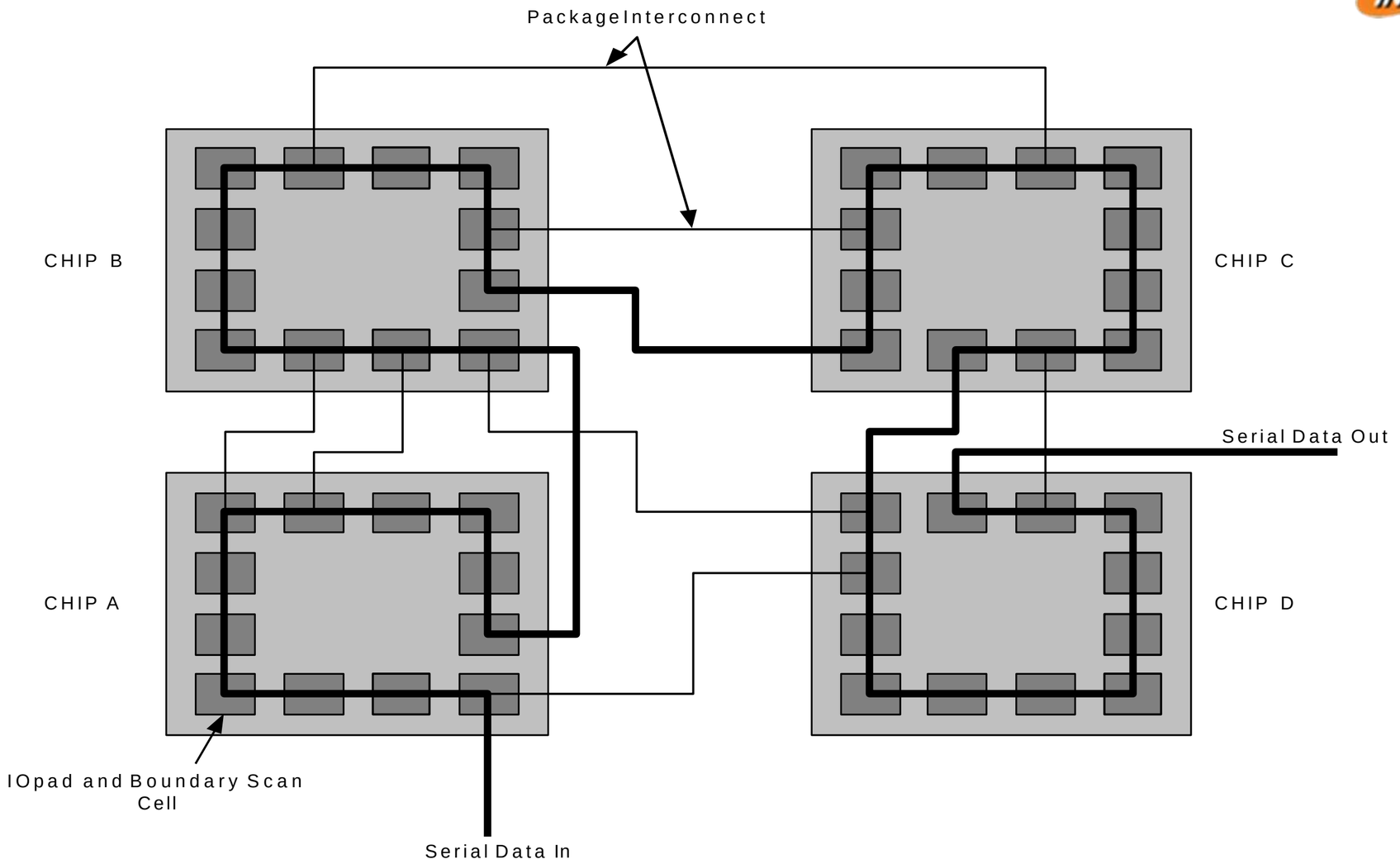
ACTIVITY

DEBATE : BOYS VS GIRLS

BOUNDARY SCAN

- Testing boards is also difficult
  - Need to verify solder joints are good
    - Drive a pin to 0, then to 1
    - Check that all connected pins get the values
- Through-hold boards used “bed of nails”
- SMT and BGA boards cannot easily contact pins
- Build capability of observing and controlling pins into each chip to make board test easier

BOUNDARY SCAN EXAMPLE



BOUNDARY SCAN INTERFACE

Boundary scan is accessed through five pins

TCK: **test clock**

TMS: **test mode select**

TDI: **test data in**

TDO: **test data out**

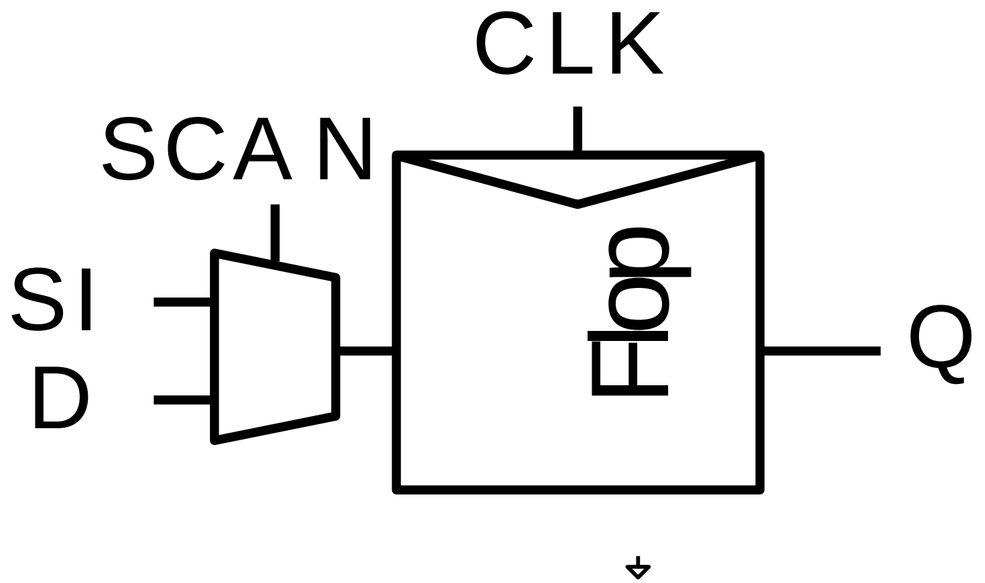
TRST*: **test reset (optional)**

Chips with internal scan chains can access the chains through boundary scan for unified test strategy.

SIMULATE

Think about testing from the beginning
- Simulate as you go
- Plan for test after fabrication

“If you don’t test it, it won’t work! (Guaranteed)”



ASSESSMENT

WRITE THE BOUNDARY SCAN PIN NAMES & FILL UP THE BLANK IN PRSG TABLE

TCK:

TMS:

TDI:

TDO:

TRST*:

Step	Q
0	111
1	------
2	101
3	-------
4	100
5	------
6	011
7	----------

SUMMARY & THANK YOU