



ASICs – Concept to Product

Synopsis

This course is aimed to provide an opportunity for the participant to acquire comprehensive technical and business insight into the ASIC world. As most of these aspects also hold true for general IC design, this course will also greatly benefit an IC Design Engineer.

Application Specific Integrated Circuit (ASIC) is a major topic of interest in the highly competitive field of VLSI circuits where each industry player tries to outdo the other by introducing a niche and differentiated product ahead of the competition. While products assembled from off-the-shelf components are faster to reach the market, they ride on an already existing product wave. With ASICs, however, one can be the forerunner and tap into the initial and major chunk of the market window grossing high revenues. The exclusive design rights also provide an added advantage.

This course will provide a basic understanding & a holistic view of the complete ASIC design flow. It will enable the participant to understand the basics involved in various phases of ASIC design with an appreciation of the links and dependencies across them. Industry insights shared in this training help the participant appreciate the ASIC design flow in a real working world.

The course is structured into modules. Short interactive workshops within the course facilitate in making this an interesting, interactive learning experience. Participants will be exposed to issues cited from real industry experience.

This course will be delivered by a senior VLSI consultant with extensive industry experience in supporting & managing ASIC projects on a global scale.

What You Will Learn

After going through this training program, the participant would have learnt

- Different aspects and phases of the complete ASIC design flow
- These include
 - ✓ Basics of an ASIC design library
 - ✓ Logic simulation and synthesis
 - ✓ Floor plan, Place & Route, Design for Manufacturability
 - ✓ Design Verification, Design for Testability
 - ✓ Low power design methodologies
 - ✓ Insight into ASIC technology and market trends
- Dependencies and links across various design phases – this, in turn, will facilitate him in comprehending how decisions made in one phase affects the other
- Be ready to handle details of each design phase

Who Should Attend

- EEE engineers who would like to start working in ASIC design
- ASIC Customer support engineers, Business Development engineers, Program Managers

Prerequisite

Basic engineering know how. 1-2 years experience in IC design/support is preferable.

Course Methodology

This course is conducted in a seminar room. The course will include brief interactive workshops like sessions to encourage participation and facilitate learning. Each participant will receive a set of course material. There are no lab sessions.

Course Duration

3 days (9am – 5pm)

Course Structure

The course is organized into modules to facilitate participants to attend a specific module(s) as per their interest/need. To extract maximum benefit from the course however, participation in all modules is recommended.

A. Introduction to ASICs

- Standard cell based ASIC
- Semi-custom ASIC and Full custom ASIC
- Basics of IC Design Flow
- Some definitions
- Generic Technology Aspects & Trends

B. Design Library

- Definition, Library Architecture
(With basic introduction to SSIs, IOs, Memories, IPs; general circuits used like Flip flops, latches, combinational circuits, RAMs, ROMs etc. will be included)
- Library Cell Representations
- Cell views (logical description, timing information, derating data, capacitance information, power and area information)
- Global views (max capacitance, interconnect info, max power and derating information)
- Library Characterization
(Standard load, trip points, parasitic caps, input slew rate, timing equation, delay calculation)
- Library Validation
- Trends in Library architecture
(Power, speed optimization, drive, contents changing with technology and trends)

C. Logic Simulation & Synthesis

1. Logic Simulation

- Simulation modes (behavioral, functional, static timing analysis, gate level simulation)
- Net capacitance
- Cell model (primitive, library, macro/IP) and test bench
- SDF in simulation
- Limitations of logic simulation

- STA

2. Logic Synthesis

- Logic synthesis in the design flow
- HDL and Synthesis – some HDL guidelines
- Constraints and operating conditions
- Memory Synthesis
- Timing driven synthesis

D. Floorplan, Placement & Routing, Finishing

1. Floorplan, Placement & Routing, Finishing

Floorplan

- Goal, objective
- Hierarchical Design
- I/O and Power planning
- Core limited and pad limited design
- Clock Planning
- Grouping and Regioning

Placement & Routing, Finishing

- Goals & Objectives
- Timing driven placement/Physical Design flow
- Information formats
- Routing (Global & detailed routing, clock routing, power routing)
- Back Annotation, Circuit extraction
- Design checks, Mask preparation

2. DFM

- Need for DFM
- Yield categories
- Yield Optimization (Critical Area Analysis, Chemical Mechanical Polishing, Lithography Compliance Check)

E. Verification, DFT

- Need for Verification
- Functional Verification
(Simulation, Formal Verification, Coverage – Code, Functional, Assertion)
- Timing Verification – STA, SSTA
- Physical Verification – DRC, LVS, Parasitic Extraction
- Design For Test (DFT)
Scan (Full scan, boundary scan)
Faults – Fault models, Fault collapsing, IDDQ test and Fault simulation
ATPG, At speed test
BIST (LFSR, Signature Analysis)

Test logic insertion

F. Low Power Design Guidelines

- Sources of power dissipation (Static, Short circuit, dynamic)
- Power distribution considerations (Temperature, package, Voltage drop, Electromigration)
- Low power design techniques and methodologies (levels of low power optimization, includes, MSV, MTCMOS, VTCMOS, encoding, logic reduction, clock gating etc.)
- Guidelines for low power design

G. ASIC construction & Managing an ASIC program

- Basic economics involved in ASIC development
- ASIC Program Flow
- Key factors to be considered at ASIC start up
- Selecting technology, library, IPs, package etc.
- Die size estimation, power estimation
- Design interfaces
- What is an ASIC program
- Different functions
- Documentation, check lists, sign-offs
- Issues seen during ASIC implementation
- Guidelines for effective ASIC program management

H. Trends in the ASIC arena

- Some definitions
- Shift in ASIC technology & the underlying reasons
- Insight into Structured ASICs/Platform ASICs
- IPs used in Platform ASIC
- Cell based ASIC vs. Platform ASIC
- Some Industry examples illustrating the trend

Course Instructor

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Ms. Meenu Sarin is a microelectronics professional with over 21 years' experience in the microelectronics industry across various facets of operations & across geographies like Europe, India, Singapore, Greater China and Australia and with special focus in the semi-custom ASIC environment. She has registered her company, VLSI Consultancy, in Singapore from where she consults offering techno-commercial services to the semiconductor industry. She has conducted in-house training courses and public workshops in various countries including Singapore, Malaysia, Hong Kong and India besides delivering talks in universities. She is also a founding member and an Executive Board Member of the Singapore Semiconductor Industry Association (www.ssia.org.sg)

From 1997-2002, Meenu was a Technical Marketing Manager in STMicroelectronics (STM)/Singapore with focus on Telecom segment. In this role, she was responsible for Business Development and Program Management for STM's semicustom ASIC projects in Asia Pacific. Meenu also worked as a Program Manager in charge of managing various semi-custom projects with customers in the Asia-Pacific Region. Before her move to STM Singapore, Meenu worked at STM India from 1991 to 1997. As a Design Manager for Library Design Group, she was responsible for growing and managing a 30 member strong team involved in design and development of semi-custom digital libraries in various technologies across different platforms as per the market requirements and to support designers in STM's worldwide locations. Prior to this, Meenu had been a Design Engineer for digital library design and development at STM Italy for several years after she received her engineering degree (Computer Engineering) from Delhi Institute of Technology, India in 1988.