What is VLSI and Why You Should Care

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What is this?
Whatever it is, looks simple.
WELL, IT GETS SLIGHTLY MORE COMPLICATED
WHAT IS THIS? SEE ANY ODDITY?
STILL NOT CLEAR?  
CAN’T SEE THE FOREST FROM THE TREES?
NOW?
NOW?
Who am I?

- Graduated from UK, 1989, BSEE
  - Electro-magnetics, EMC, one laser class
  - No hard-core semiconductor class
- Masters, Ph.D., Rice University
  - Laser interaction with semiconductors
  - Semiconductor research with Texas Instruments
- Texas Instruments, 1995-2000
- Cypress Semiconductor, 2000-present
- UK, 2000-present

- I was sitting in your seat 15-20 years ago
- I thought I was going to be a laser / EM engineer
Why you should care?

• One day you will graduate, then what?
• Do you want to apply your previous class work?
• What are your options for jobs or grad school?
  – Possibilities you may not have thought of

• EE584 Intro to VLSI may help your career decision
But I’ve heard the class is hard and the instructor is .....

• EE584 is taught as a segue to the real world
• Cypress Semiconductor has hired 14 recent graduates
• Others have found jobs at:
  – TI, Intel, Silicon Valley start-ups
• These are high-paying, cutting-edge companies
• “Hard” classes are relative to your expectations
  – Your competition: thousands of EE grads each year
  – Are you going to settle for lower echelon jobs?
• As far as the instructor, .....


What is expected from an engineer?

• **Hours:**
  - 8am → 6pm (nominally)
  - 7am → 12am (sometimes)

• **Skills:**
  - Typing
  - Speaking
  - Reading
  - Simple programming (except SW engineers)
  - Flexibility (try new things)
  - Paying attention, energy, enthusiasm
  - Playing well with others

• **List is independent of your specialty**
What can VLSI do for me?

- **Jobs**
  - Industry is cyclical, but drives economy

- **Grad school**
  - New technologies to replace Silicon needed

- **VLSI can lead you to:**
  - West Coast (OR, CA)
  - East Coast (NY, MA, NJ, NC)
  - Midwest (IL, MN)
  - Southwest (TX, AZ)
  - International (India, Ireland, Germany, Denmark, England, Japan, Taiwan, China)
What do you learn/use in VLSI?

- Physics
- Chemistry
- Software
- Presentations
- Documentation
- What is important in order to get a job

- FALL  VLSI INTRODUCTION    MWF 9am
- SPRING  ADVANCED VLSI       MWF 9am
BACKUP
What are possible jobs I could do?

• **Software**
  – Web interfaces: financials, data mining
  – Scripts to automate manual tasks

• **Hardware**
  – Production: large volumes (hundreds – millions)
  – Engineering: small volumes (one, two, ten)

• **Writing**
  – Documentation of what you just did
  – Simple, yet hard to accomplish

• **Speaking**
  – Management, communicate effectively
  – Believable, trustworthy
What is VLSI? Should I still care?

• Very Large Scale Integration

• VLSI and semiconductors should excite you

• Why should you care?
  – In a word → Jobs
  – Another word → Skills
  – Learn how to make computer chips
  – Cutting edge technology
  – There is a need for wide ranging interests
  – Chemistry, Design, Physics, Video, Audio, Hardware, Software, Writing
  – Graduate programs support this industry
What is a semiconductor?

• Small switch
• Put lots of them together, you get a chip
• Used in
  – Cell phones
  – Computers
  – Toasters
  – Cars
  – Everything ........
How much does an engineer get paid?

- 2001 IEEE Salary Survey: Median $93k (n=9,700)
  - Experience level
  - This is not a starting salary
  - Typically takes 10 years work experience

- Education level
  - Ph.D. = Master + (3 to 5)
  - Master = Bachelor + (3 to 5)
Recent Trends


Sales ($B)

Percent Change

Recent Trends

Recession

Boom

Recession

Boom

Recession

Boom

Recession

Recession

Recession
How Many Chips?

10 MILLION WAFERS * ~500 CHIPS / WAFER = 5 BILLION CHIPS / QUARTER

EACH CHIP $0.50 – $50

Wafers (Millions) vs. Time

Year-Quarter

Who Hires VLSI-Types?

- **Semiconductor companies**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>Sales</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Intel</td>
<td>23.5</td>
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<tr>
<td>2</td>
<td>ST Micro</td>
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<td>3</td>
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<td>4</td>
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<td>5</td>
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<td>6</td>
<td>Motorola</td>
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<td>7</td>
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<td>8</td>
<td>Infineon</td>
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<td>9</td>
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<tr>
<td>10</td>
<td>AMD</td>
<td>3.9</td>
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- **Fab-less “Design Houses”**

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<td>0.36</td>
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Size, Speed Trends

Present solutions will no longer work in 2005
Scale: human hair → 100,000 nm, red blood cell 5,000 nm