WHAT IS VLSI
AND WHY YOU SHOULD CARE

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Cypress Semiconductor
SHOULD YOU TAKE VLSI?

• YES
• APPLY / LEARN / RE-LEARN:
  – Physics
  – Chemistry
  – Software
  – Presentations
  – Documentation
  – What is important in order to get a job

• FALL
  – 584 TR 3:30 – 4:45 FALL
  – TIME SUBJECT TO CHANGE BASED ON FEEDBACK

• SPRING
  – 599 ADVANCED VLSI TOPICS
BUT I’VE HEARD THE CLASS IS TOO HARD

• BASED ON STUDENT FEEDBACK, THE SOFTWARE COMPONENT HAS BEEN SCALED BACK IN RECENT YEARS

• CLASS IS A SEGUE INTO THE REAL WORLD
WHAT IS THIS?
IS THIS *THAT* DIFFICULT?
WELL, IT GETS SLIGHTLY MORE COMPLICATED
WHAT’S WRONG WITH THIS PICTURE?

18M DUAL PORT SRAM 0.1um CHANNEL
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
  – 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
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 20 years ago
WHAT DO YOU DO IN VLSI?

• APPLY WHAT YOU ALREADY HAVE STUDIED
  – BASIC SEMICONDUCTOR OPERATION
  – PHYSICS
  – CHEMISTRY

• LEARN INDUSTRY STANDARD SOFTWARE
  – MENTOR GRAPHICS LAYOUT, SCHEMATICS, SIMULATION

• UNDERSTAND WHAT IS IMPORTANT
  – LOTS OF INFORMATION, WHAT IS USEFUL?
  – HOW TO THINK LIKE AN ENGINEER
WHAT CAN VLSI DO FOR ME?

• Jobs
  • Although Kentucky traditionally does not have a large semiconductor presence, there is at least one example:
    – Cypress

• However, knowledge of this industry can lead you anywhere:
  – 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)
RECENT TRENDS

Year

Sales ($B)

-50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100

Percent Change


Boom Boom Boom Boom Boom

Recession Recession Recession Recession Recession
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 a semiconductor?

• Small switch
• Put lots of them together, you get a chip
• Used in
  – Cell phones
  – Computers
  – Toasters
  – Cars
  – Everything ……..
Historical Trends
How Many Chips?

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

EACH CHIP $0.50 – $50

Wafers (Millions) vs. Time
## Who Hires VLSI-Types?

- **Semiconductor companies**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>2001 Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intel</td>
<td>23.5</td>
</tr>
<tr>
<td>2</td>
<td>ST Micro</td>
<td>6.4</td>
</tr>
<tr>
<td>3</td>
<td>Toshiba</td>
<td>6.1</td>
</tr>
<tr>
<td>4</td>
<td>TI</td>
<td>6.0</td>
</tr>
<tr>
<td>5</td>
<td>Samsung</td>
<td>5.2</td>
</tr>
<tr>
<td>6</td>
<td>Motorola</td>
<td>4.8</td>
</tr>
<tr>
<td>7</td>
<td>NEC</td>
<td>4.8</td>
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<tr>
<td>8</td>
<td>Infineon</td>
<td>4.6</td>
</tr>
<tr>
<td>9</td>
<td>Philips</td>
<td>4.4</td>
</tr>
<tr>
<td>10</td>
<td>AMD</td>
<td>3.9</td>
</tr>
</tbody>
</table>

- **Fab-less “Design Houses”**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>2001 Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Qualcomm</td>
<td>1.24</td>
</tr>
<tr>
<td>2</td>
<td>Nvidia</td>
<td>1.21</td>
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<tr>
<td>3</td>
<td>Xilinx</td>
<td>1.15</td>
</tr>
<tr>
<td>4</td>
<td>Via</td>
<td>1.01</td>
</tr>
<tr>
<td>5</td>
<td>Broadcom</td>
<td>0.96</td>
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<tr>
<td>6</td>
<td>Altera</td>
<td>0.84</td>
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<tr>
<td>7</td>
<td>Cirrus Logic</td>
<td>0.53</td>
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<tr>
<td>8</td>
<td>ATI Techn</td>
<td>0.52</td>
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<tr>
<td>9</td>
<td>Media Tek</td>
<td>0.45</td>
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<tr>
<td>10</td>
<td>QLogic</td>
<td>0.36</td>
</tr>
</tbody>
</table>
How much does an engineer get paid?

• 2001 IEEE Salary Survey: Median $93k (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)
Size, Speed Trends

Present solutions will no longer work in 2005
Scale: human hair → 100,000 nm, red blood cell 5,000nm
What is expected from an engineer?

• Hours:
  – 8am → 6pm (nominally)
  – 8am → 12am (sometimes)

• Skills:
  – Typing
  – Speaking
  – Reading
  – Simple programming (except SW engineers)
  – Flexibility (try new things)
  – Paying attention, energy, enthusiasm

• List is independent of your specialty