Lithography

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Lithography Overview

• Optical Lithography has been the main method for manufacturing.
• Optical Lithography is expected to continue as such until 45nm through techniques such as; OAI, PSM, and OPC.
• The 32nm node is viewed as beyond the scope of optical lithography.
Lithography Difficulties

• Mask fabrication and process control
• Cost control/Return on investment.
• Metrology and defect inspection.
• Tools for mass production.
• Gate CD control improvements.
Lithography Difficulties Cont.

• The ITRS roadmap shows up until the year 2009 or 65nm solutions are known for most lithography requirement.

• In 2010 and beyond the ITRS roadman does not know how to solve many lithography technology requirements.
## ITRS Lithography Roadmap Exp.

<table>
<thead>
<tr>
<th>Production Year</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Node</td>
<td>hp90</td>
<td>hp65</td>
<td></td>
<td></td>
<td></td>
<td>hp45</td>
</tr>
<tr>
<td><strong>DRAM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRAM ½ Pitch (nm)</td>
<td>80</td>
<td>70</td>
<td>65</td>
<td>57</td>
<td>50</td>
<td>45</td>
</tr>
<tr>
<td>Contact in resist (nm)</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>60</td>
<td>55</td>
</tr>
<tr>
<td>Contact after etch (nm)</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>65</td>
<td>55</td>
<td>50</td>
</tr>
<tr>
<td>Overlay</td>
<td>28</td>
<td>25</td>
<td>23</td>
<td>21</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>CD control (3 sigma) (nm)</td>
<td>9.8</td>
<td>8.6</td>
<td>8</td>
<td>7</td>
<td>6.1</td>
<td>5.5</td>
</tr>
</tbody>
</table>
Potential Lithography Solutions

• Past 45nm, Next-Generation Lithography (NGL) technologies are expected to emerge over optical lithography to keep up with Moore’s law.
  – Extreme Ultraviolet Lithography (EUV).
  – Electron Projection Lithography (EPL)
  – Imprint Lithography
Potential Lithography Solutions Cont.

• Although there are many technology approaches that exist the industry is limited in its ability to fund the simultaneous development of multiple technology.

• “Closely coordinated global interactions within industry and the universities are absolutely necessary to narrow the options for these future generations.”

THE INTERNATIONAL TECHNOLOGY ROADMAP FOR SEMICONDUCTORS: 2003