





Where Does Each Technology Fit?


Jim Handy
Semico Research Corp
August 10, 2006



HDD vs. NAND


- HDD will always have lower \$/GB
- NAND will always have lower unit price
- Pricing trumps other differences
 - Power consumption
 - Physical size
 - Ruggedness
 - Weight
- NAND will be used *with* HDDs for cache






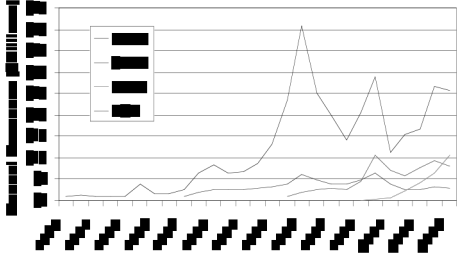
NAND vs. NOR


- Each has its strengths
 - NAND: Cost, fast writes
 - NOR: Random access
- Some applications are natural
 - NAND: Images, audio, video, HDD look-alikes
 - NOR: Code storage
- Other applications are battlegrounds
 - Combined code/data storage
 - Camera phones
 - MP3 phones
 - *Must* the solution be monolithic?
- Technical hurdles influence designs






Key Memory Markets 1979-2005









New Memories vs. Flash

- Hard to beat silicon's cost structure
 - Well understood
 - >\$200B invested in understanding silicon
- Other materials proving difficult
 - Many attack underlying silicon
 - Require special handling
- Flash technology continues to scale
 - Prior expectation – Trouble below 60nm
 - Today's expectation – Challenges at 35nm
 - Future findings – Beyond today's dreams





Summary

- NAND & HDD will coexist
 - HDD for large storage in pricey devices
 - NAND for smaller storage at lower prices
- NAND & NOR will coexist
 - Some applications will prefer one or the other
 - Other applications will use both
- Exotic Memories will find it tough
 - Silicon usually more cost-effective

