

# Semiconductor Industry Overview for Diverse Suppliers

April 13, 2006

ISMI Supplier Relations Action Council's  
Supplier Diversity Committee

INTERNATIONAL SEMATECH



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# Content and Purpose

- **Content**
  - SEMATECH's Supplier Relations Action Council (SRAC) wishes to increase participation by diverse businesses in the semiconductor industry
    - However resources that provide prospective diverse businesses with information about the industry and its unique characteristics are limited
- **Purpose**
  - This report is the outcome of an industry wide study commissioned by SEMATECH. The report will provide diverse business with the following information:
    - Semiconductor industry trends and key differences compared to other manufacturing industries
    - What prospective suppliers must know to ensure they have resilient business models and value propositions to be successful
    - Viewpoints from purchasing and sourcing managers on how new suppliers are selected and selection criteria

# Industry Definition of a Diverse Supplier

- A. Minority-owned business that is at least 51% owned and controlled by one or more members of the following minority groups:**
- African-American
  - Hispanic American
  - Asian and Pacific Islands American
  - Native Americans and Alaskan Native American
- B. Women-owned business that is at least 51% owned and controlled by a woman or women**
- C. A small business that meets the size standards set by the U.S. Small Business Administration (SBA) and the established following sub-classifications:**
- Service disabled veteran enterprise
  - Veteran business enterprise
  - Hub zone small business
  - Small disadvantaged business

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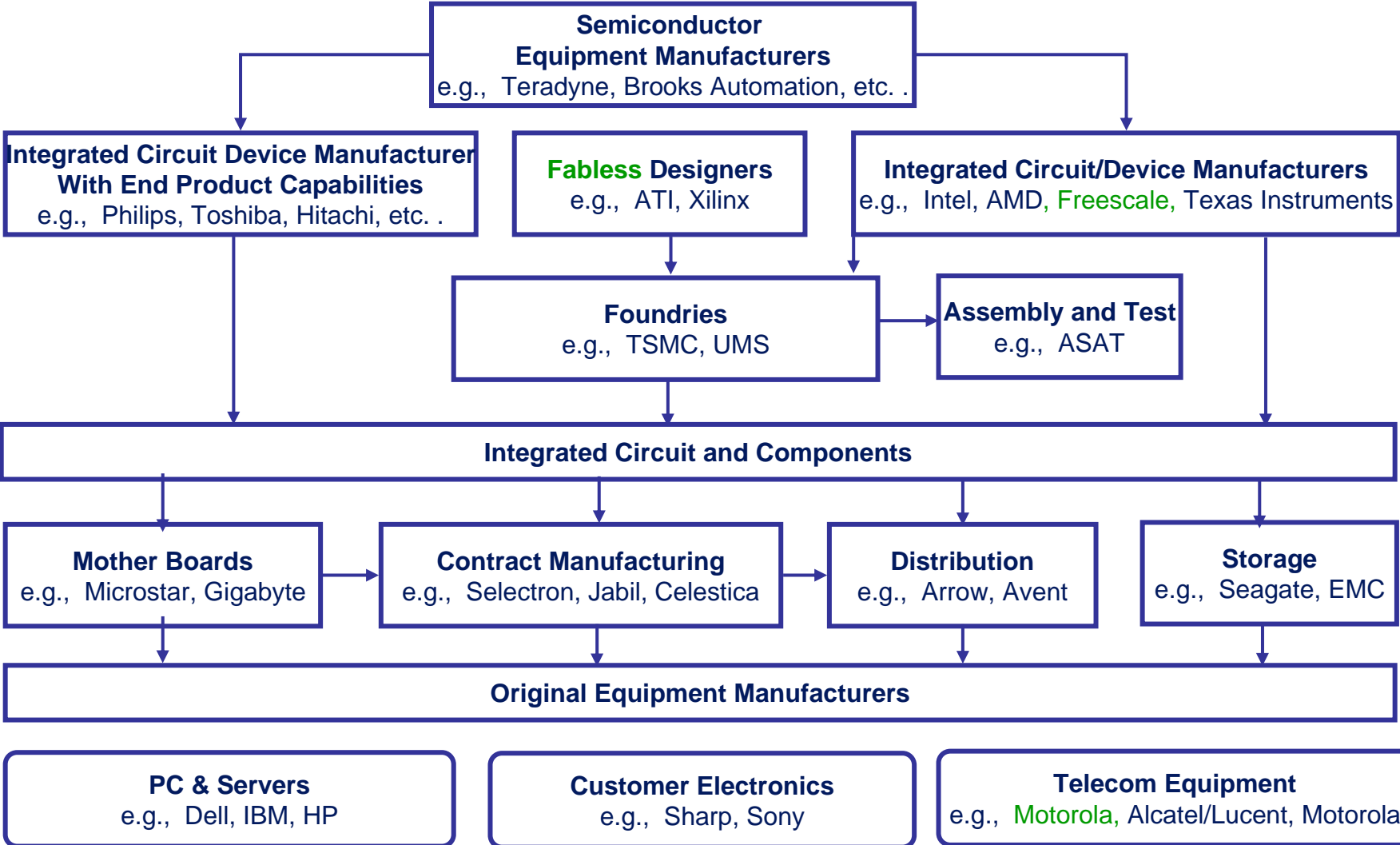
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# Key Observations About the Semiconductor Industry

Global, high volatility, constant innovation, and two dominant value chains

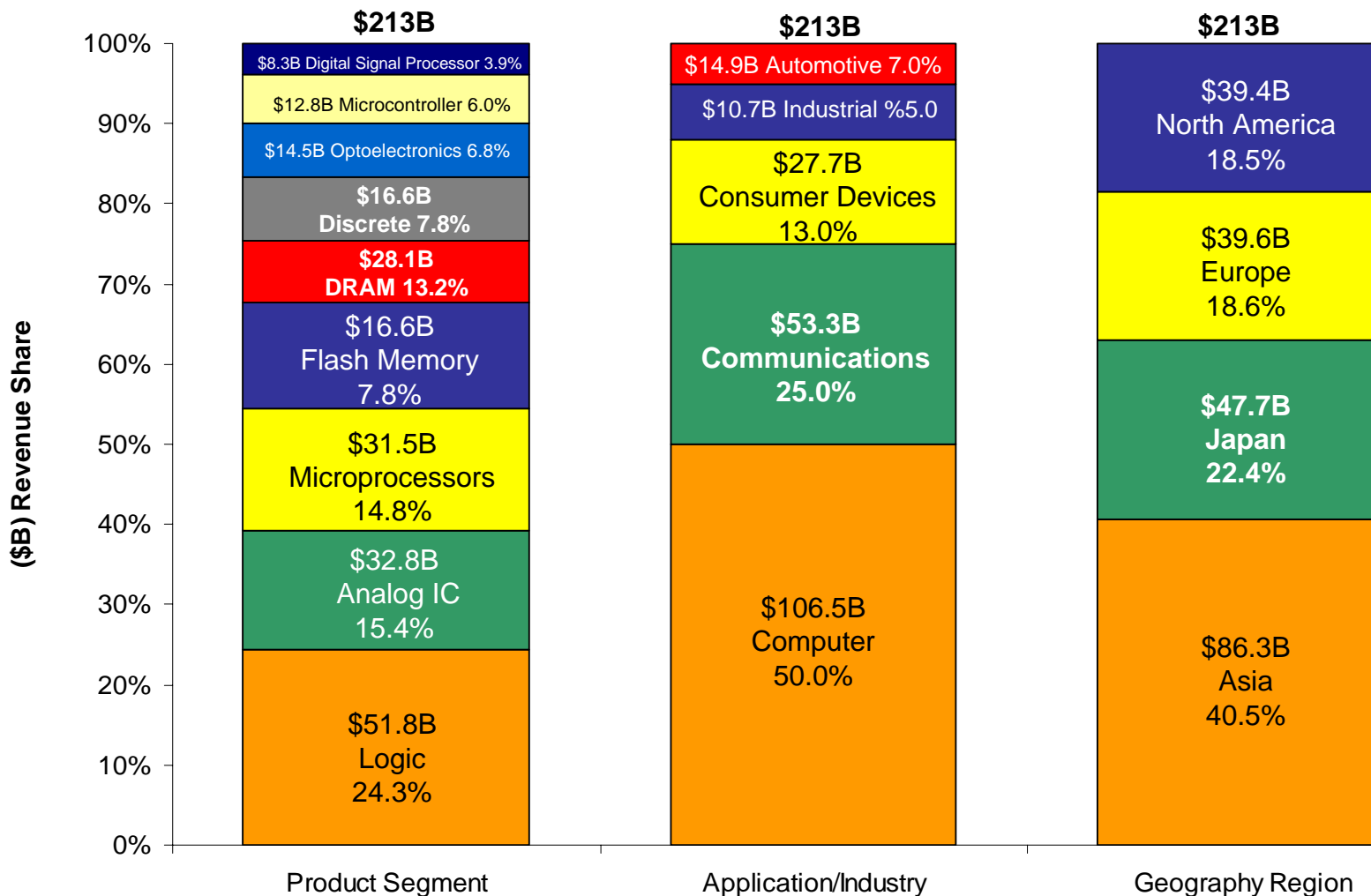
- **Semiconductor revenues are globally distributed, with Asia-Pacific forecasted for significant future growth**
  - Successful suppliers must embrace a global marketplace
  - Most sourcing growth will not be in the U.S. but in the Asia-Pacific region
- **Industry experiences more business cycles and higher volatility than other industries**
  - Suppliers must have very resilient business models
  - Diverse suppliers must understand this volatility and cyclicity – Very different from traditional manufacturing industries
- **The industry has two distinct value chains – Integrated Chip Fabrication and Semiconductor Equipment Manufacturing**
- **Constant innovation is needed to keep up with “Moore’s Law”**
  - Moore’s law does not happen naturally; it is technology- and innovation-driven
  - Industry revenues are impacted by market demand and technology needs
    - Results in a high level of capital expenditures in 3- to 4-year cycles
- **Some industry consolidation and restructuring occur at lower tiers of the equipment manufacturing value chain**

# Industry Overview – The Big Picture



# Semiconductor Industry is a \$213B Global Industry

2004 Semiconductor Revenue

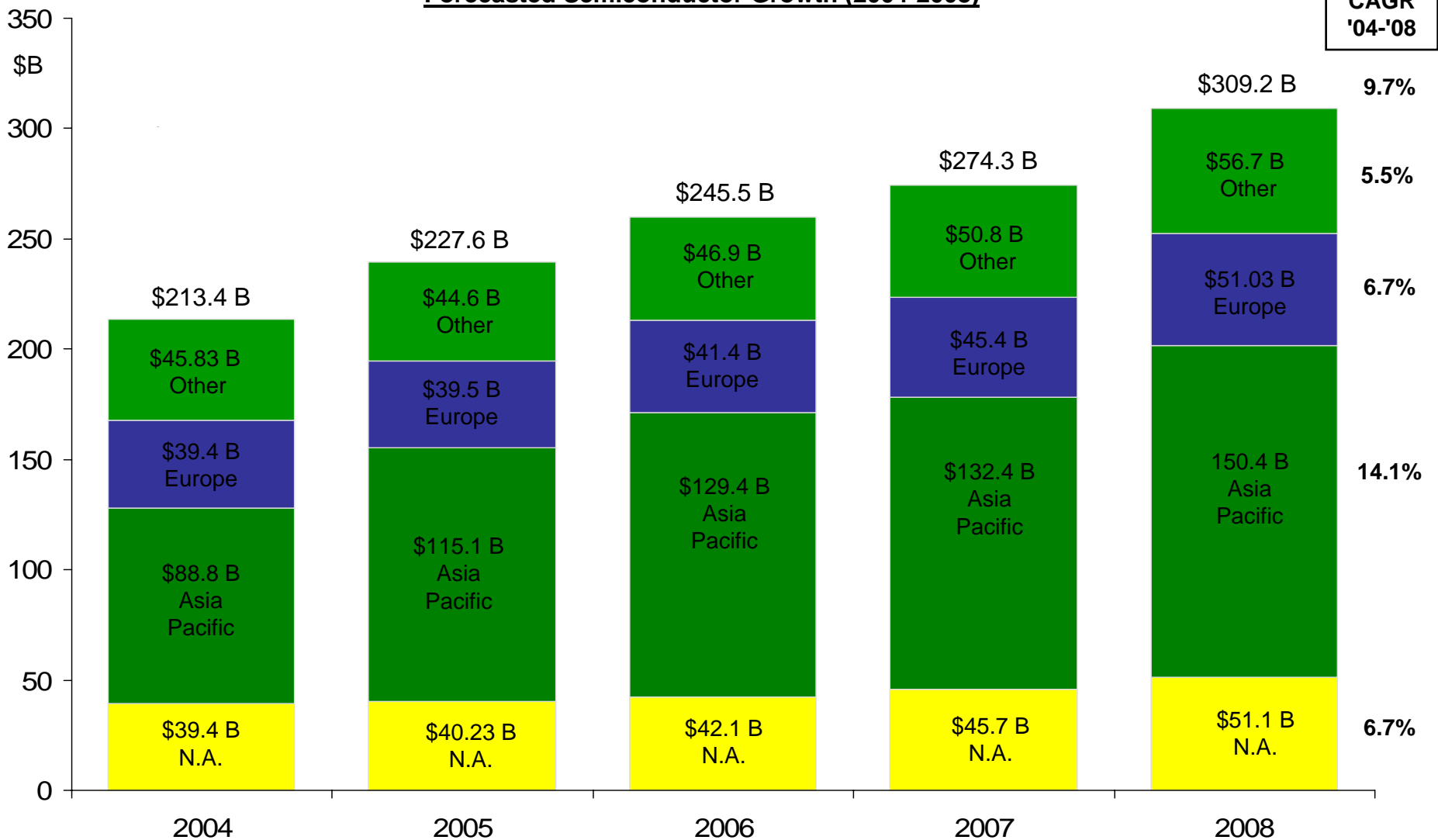


Source: RDS, Asaba Group Analysis, IC Insights

# Industry Forecasted to Grow at 9.7% CAGR Through 2008

Most semiconductor chip consumption occurring in Asia-Pacific region

Forecasted Semiconductor Growth (2004-2008)

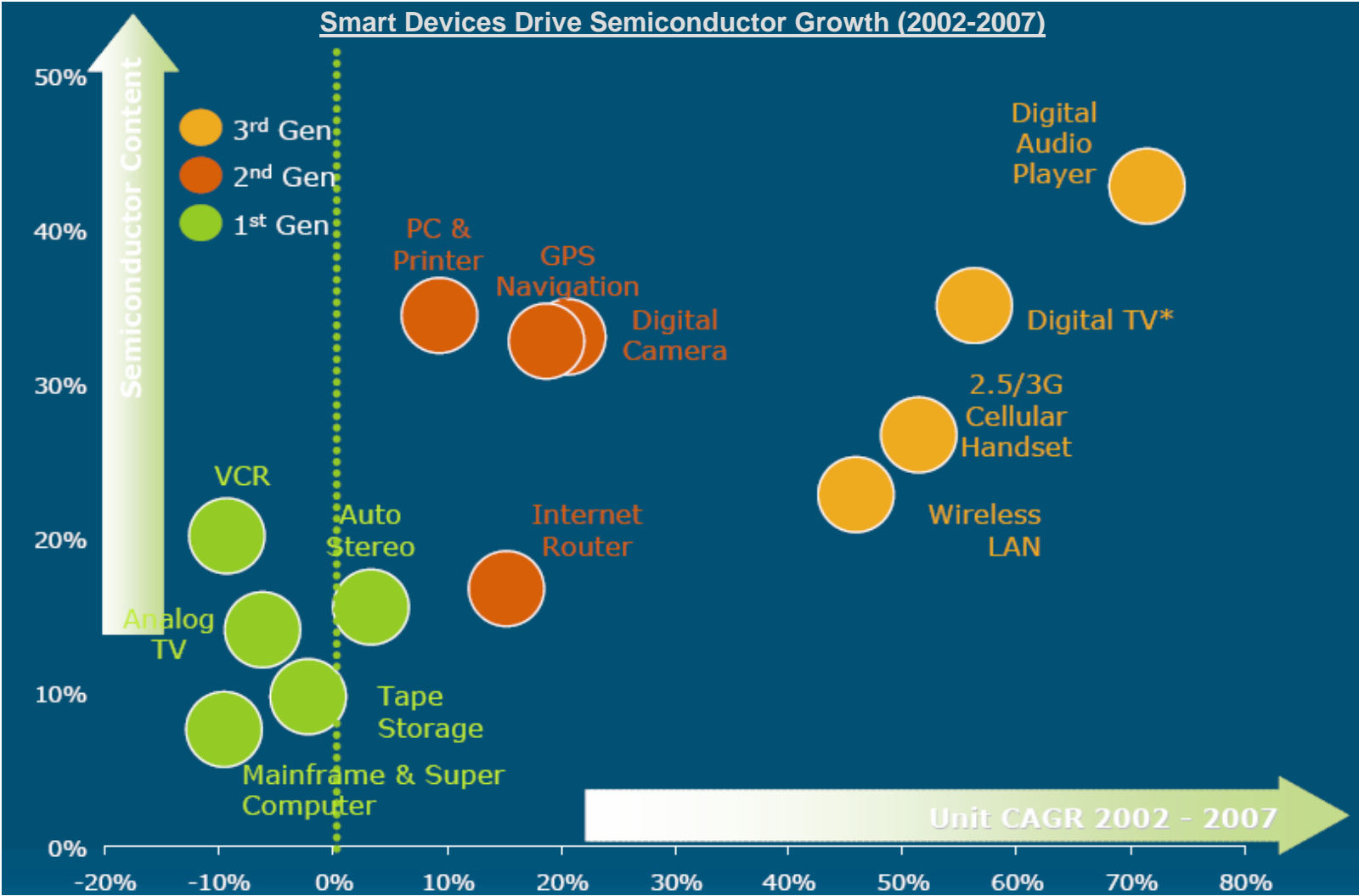


# Industry Growth Drivers

Cheaper, better, and faster chips in consumer applications

- **A continuous drive for cheaper, faster, and better chips**
  - Semiconductor companies strive to grow or maintain market share
  - Capacity increases contribute to lower prices
  - Faster introduction of new products – Shorter product cycle
- **Increase demand for consumer products**
  - Strong demand for microchips including personal computers, digital televisions, and wireless communications
  - New technology demands more semiconductor content (e.g., DVRs have 4 times the number of chips than DVD players)
  - Consumer spending on electronic products grew 11% in 2004
- **Semiconductor manufacturers getting closer to the end consumer**
  - More instances of “ingredient branding” occurring in the industry – “Intel Inside,” Texas Instruments DLP, etc. .
- **Semiconductor industry impacted by economic growth**
  - Weak economy affects semiconductor shipment volumes and investments

# Consumer Electronic Products Account for Large Share of Industry Growth

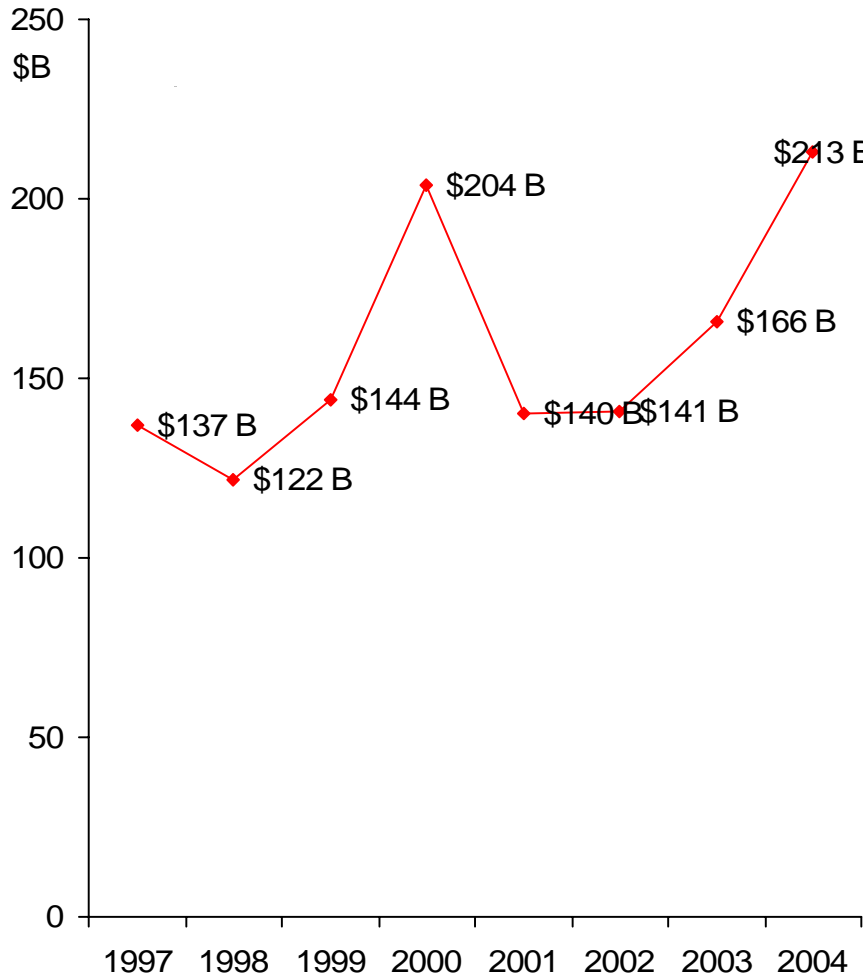


Source: Dataquest; Applied Materials, \*Excludes Digital TVs

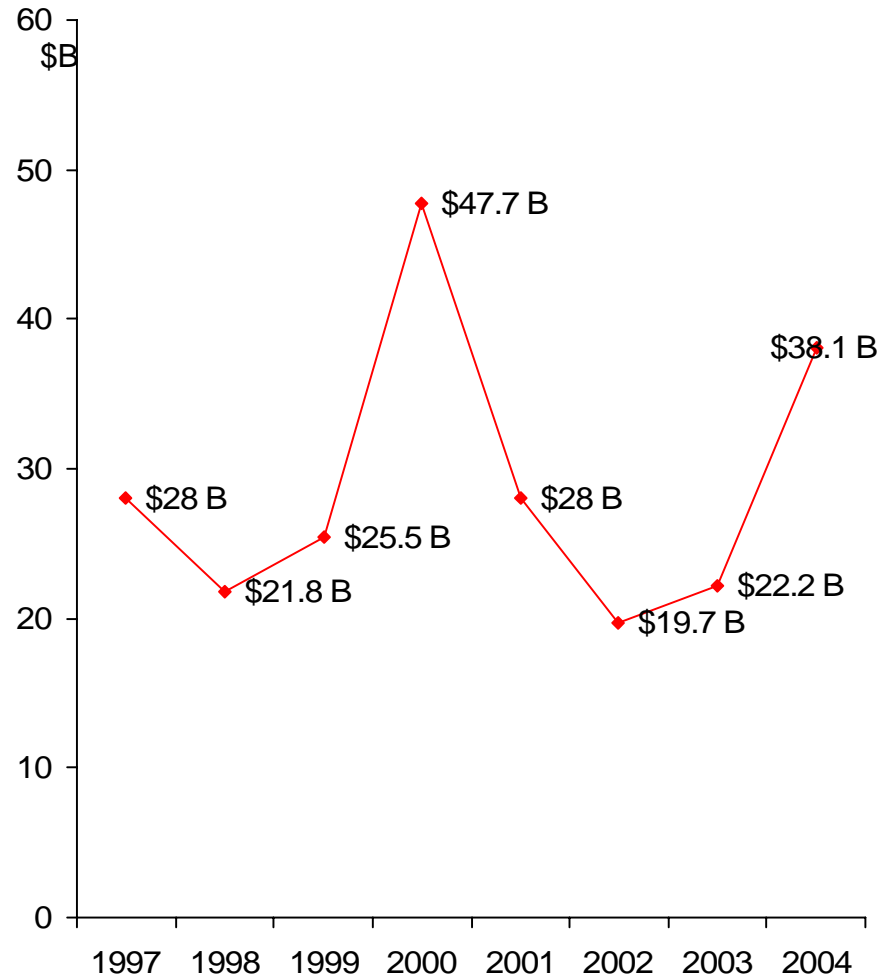
# In the Past Ten Years, the Industry Has Seen Two Business Cycles

Both impacted chip manufacturing and equipment manufacturers

Industry Sales Revenues (1997-2004)



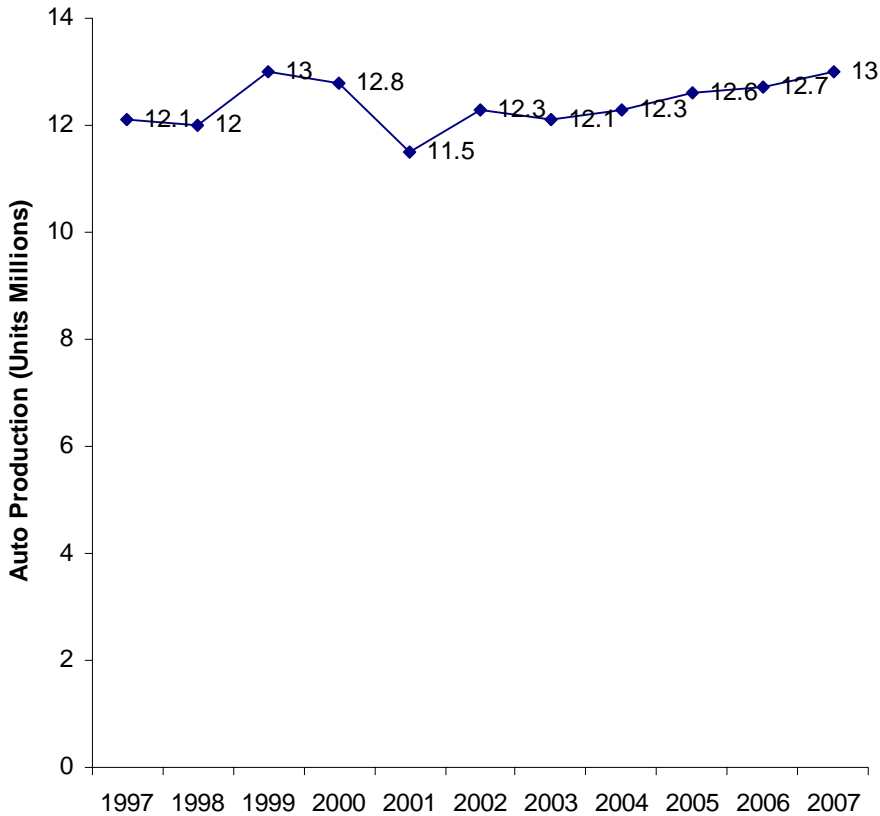
Semiconductor Equipment Spending (1997-2004)



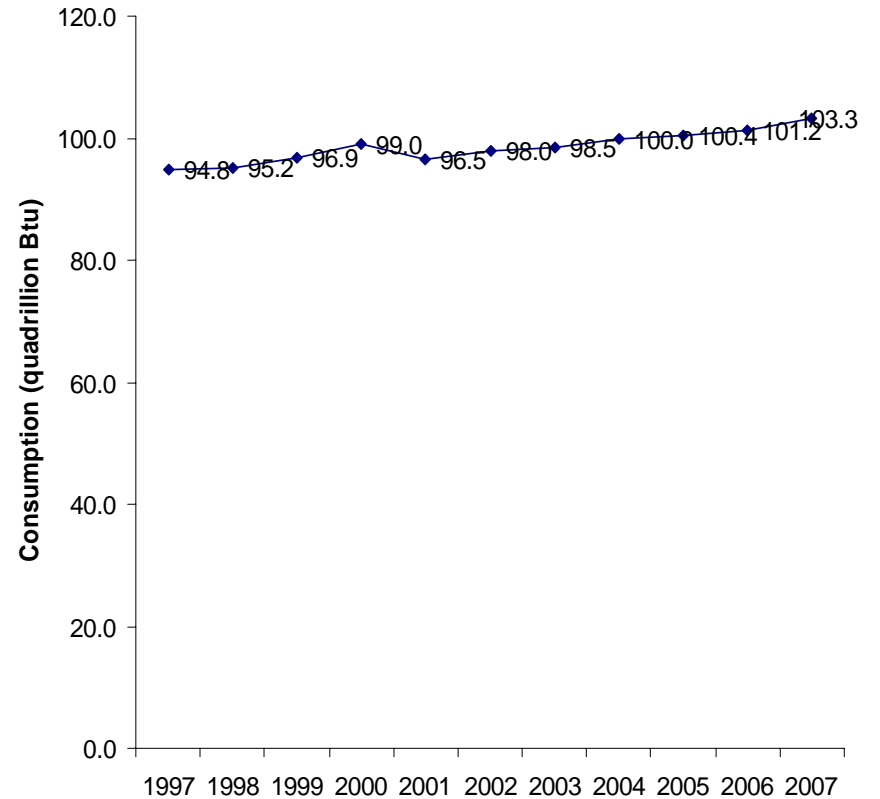
# When Compared to Automotive and Energy Industries

Semiconductor industry is very cyclical

U.S Auto Production Units (1997-2004)



U.S. Energy Consumption (1997-2004)



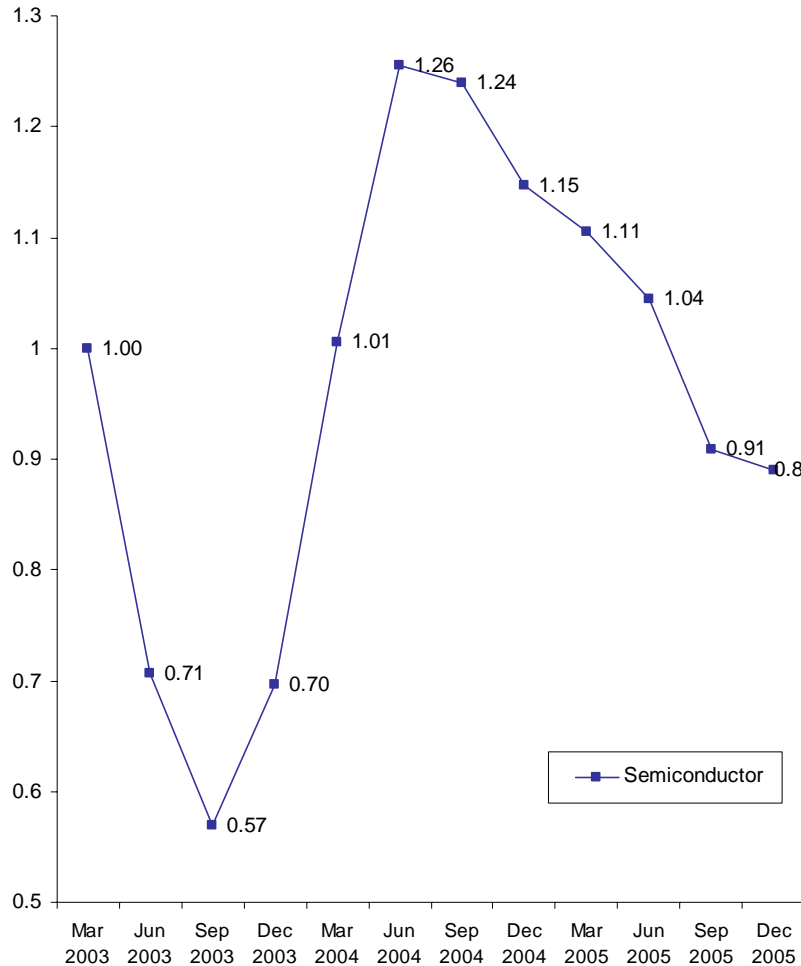
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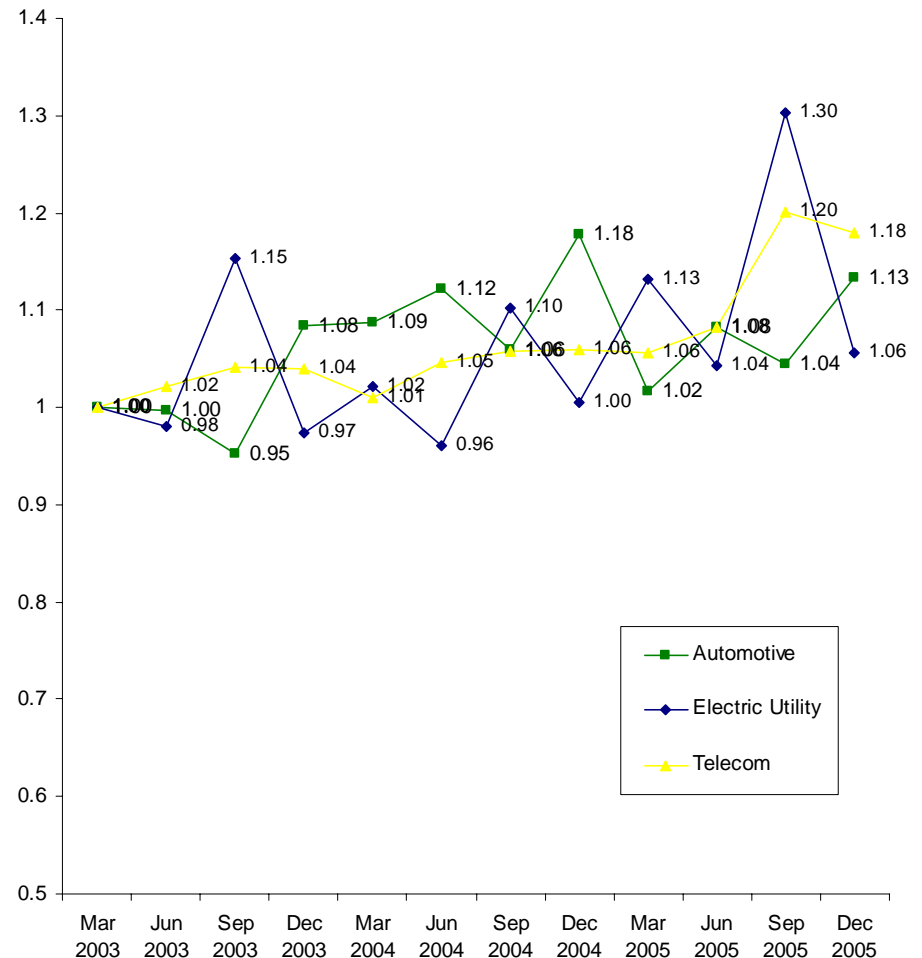
# Volatility Is More Pronounced than Other Industries

Most diverse businesses need to understand this dynamic and its business impact

### Semiconductor Revenue Trend

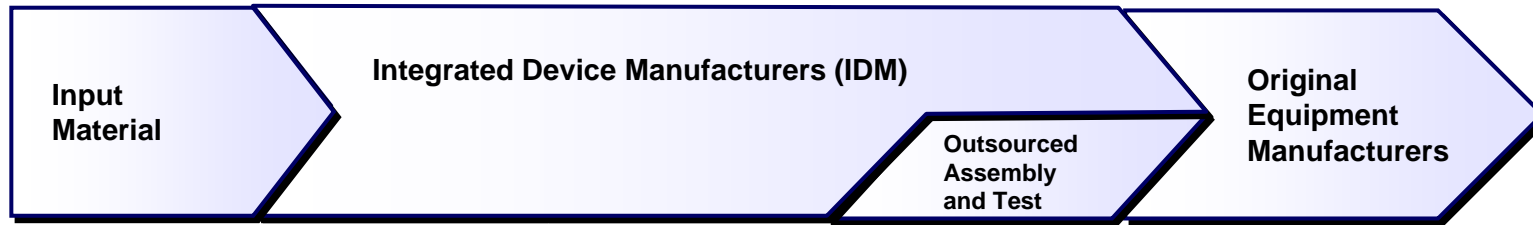


### Revenue Trend for Benchmarked Industries



# Semiconductor Industry Has Two Dominant Value Chains: Silicon Chip Fabrication and Equipment Manufacturing

## Chip Fabrication



- ATMI Inc.
- Rohm and Hass
- Air Products
- MEMC

- Intel Corp
- Freescale
- AMD/Spansion
- Texas Instrument
- Infineon

- Amkor
- ASE Tech
- ASAT Holdings

- PC Manufacturer
- Wireless Devices
- Mobile Entertainment

## Equipment Manufacturing



- MKS Instruments
- Brooks Automation
- Credence System
- Form Factor.

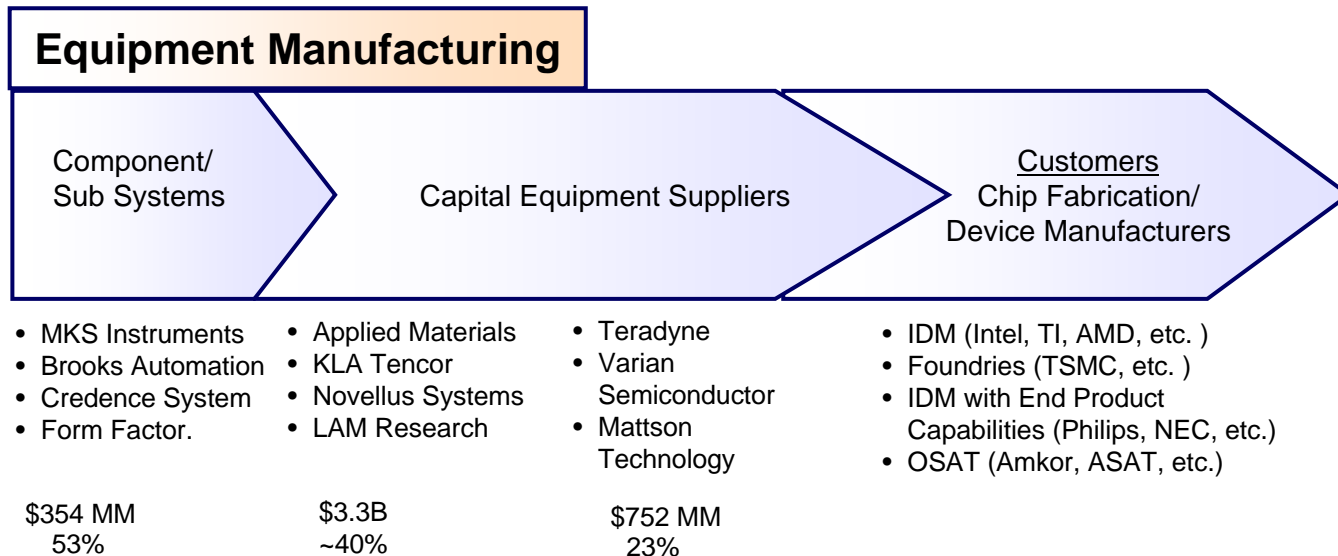
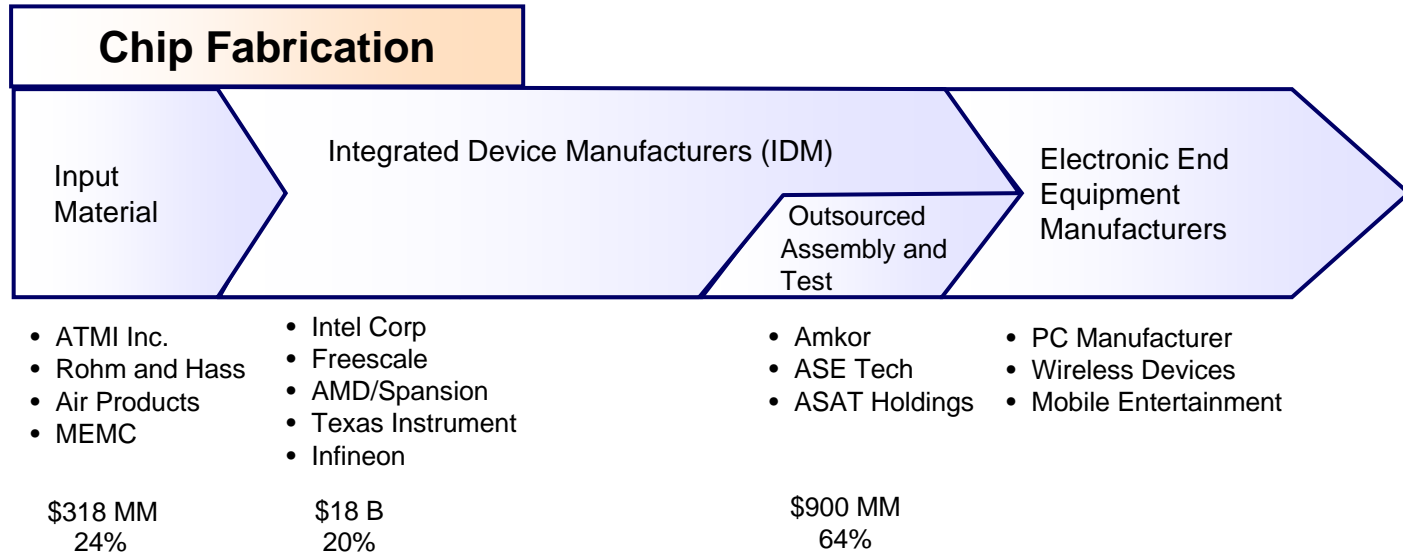
- Applied Materials
- KLM
- Novellus Systems
- LAM Research

- Teradyne
- Varian Semiconductor
- Mattson Technology

- IDM (Intel, TI, AMD, etc. )
- Foundries (TSMC, etc. )
- IDM with End Product Capabilities (Philips, NEC, etc. )

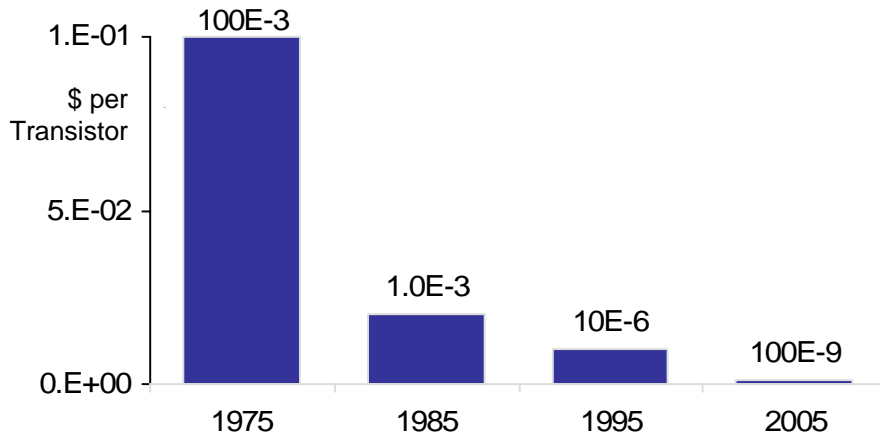
# However Limited Domestic Sourcing Opportunities in Chip Fabrication – Most Revenues Outside U.S.

Better domestic opportunities in Equipment Manufacturing

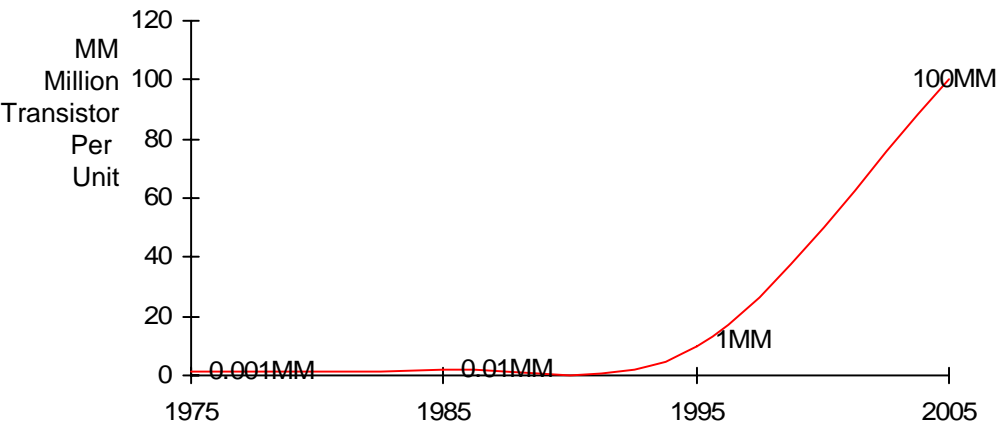


# Pursuit of Low Cost and Innovation Are Primary Economic Drivers in the Industry

Cost per Transistor (1975-2005)



Transistor Content per Unit (Estimate)



## Industry Economic Drivers

Technology evolution creates new generation every 3 to 4 years

- Lithography moving from 90 nm to 65 nm Expect 45 nm by 2007
- 300 nm wafer size

Moore's Law demands innovation that doubles transistor densities every 18 to 24 months

Results in new evolution in technology leads to

- Cheaper, faster, better, and smaller chips

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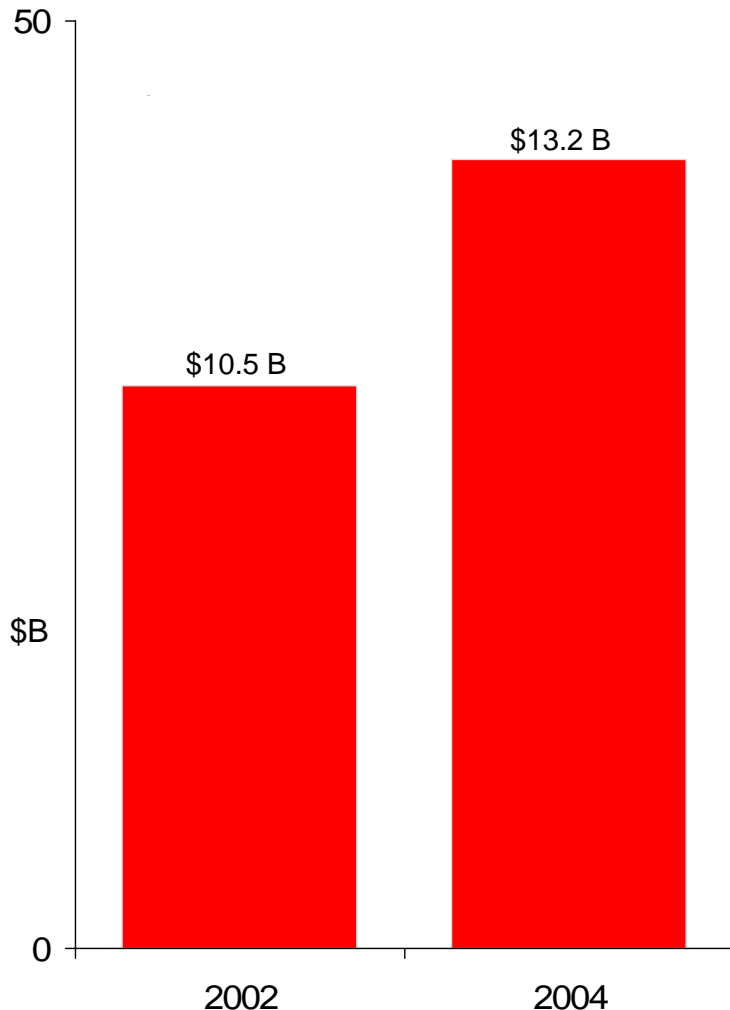
# Management Interviews

## Reinforce the Innovation Requirement

- “Wafer dies are getting smaller. There’s a bigger demand for more sensitive measurement tools. Lithography will be even smaller than the 45 nm in the future. Diverse suppliers need to understand and be aware where the next generation of technology is leading to.”
- “There’s a constant drive to develop smaller chips. There’s a move towards X-ray measuring tools that provide better sensitivity and accuracy.”
- “There will be special layers of dielectric materials that will be more complex. New elements will be used and will increase developmental costs.”
- “Chemicals need to be cleaner and purer. New products require chemicals with higher levels of purity.”
- “In materials, its not so much the type of material, but the next generation of materials. For example, another way to get more chips is to get the die smaller. Chips are getting smaller every few years. Suppliers need to understand how to adapt their products to these trends.”
- “There has been growth in advanced coatings. Advanced coatings improve the lifetime of the product and lower defect rates.”

# The Need For Constant Innovation Drives Growth in Equipment Spending

SRAC Capital Equipment Spending (2002-2004)



CAGR  
02-04

12.1%

## Trends and Drivers for Capital Equipment

Increase in wafer size from 200 nm to 300 nm

- Improves productivity and cost performance
- Drives for more fab automation

Photo mask evolution (lithography)

- From 90 nm nodes to the 65 nm mode
- Shorter wavelengths in photolithography

Migration towards low dielectric materials (Insulation b/w metal layers)

- Two competing processes: chemical vapor deposition (CVD) and spin-on

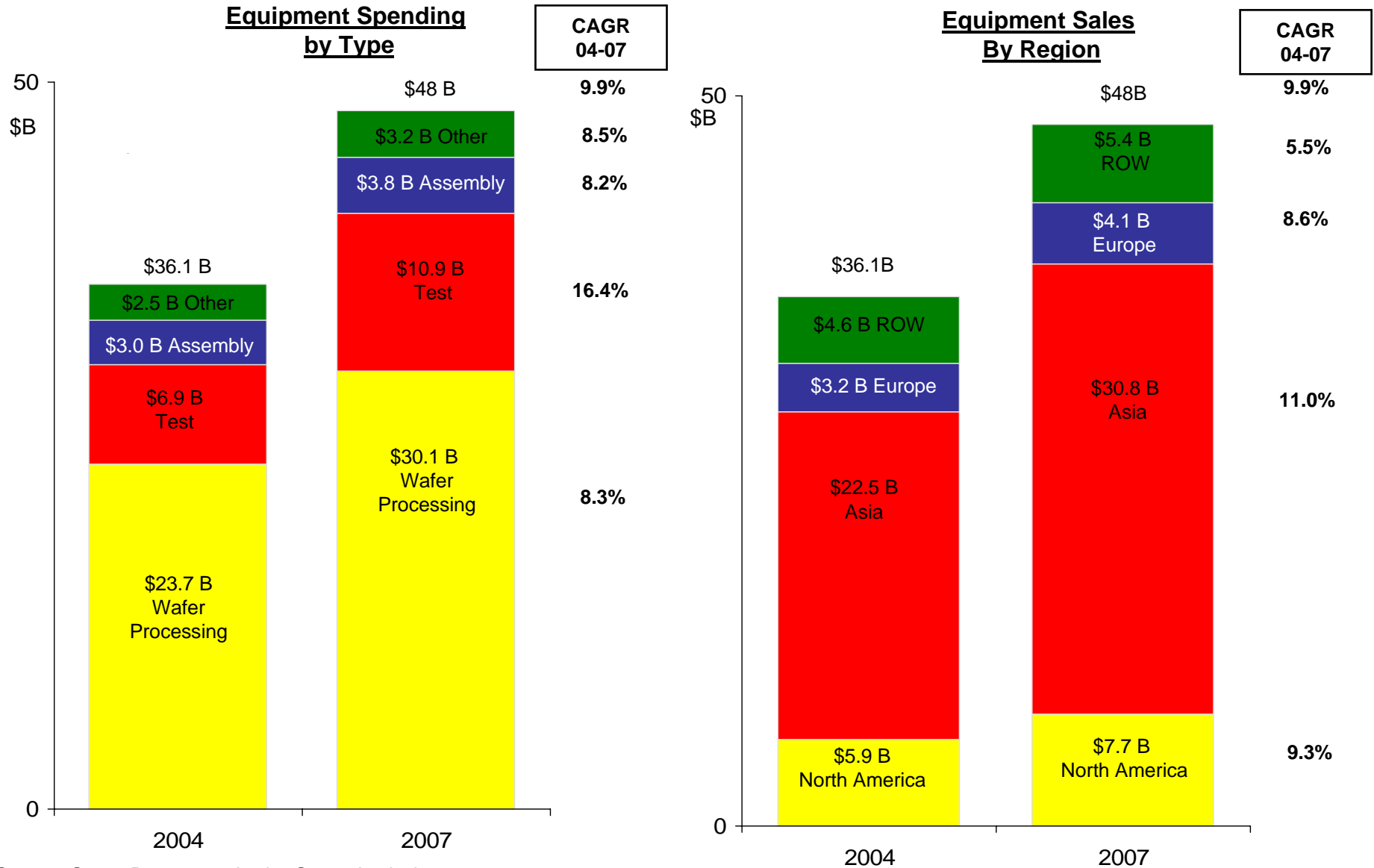
Interconnects moving from aluminum to copper

Asia-based foundries growing faster than Industry

- In 2004, grew at 44% compared to 28%

# Equipment Spending Expected to Grow at 10% CAGR

## Growth seen in the U.S. and Asia-Pacific regions

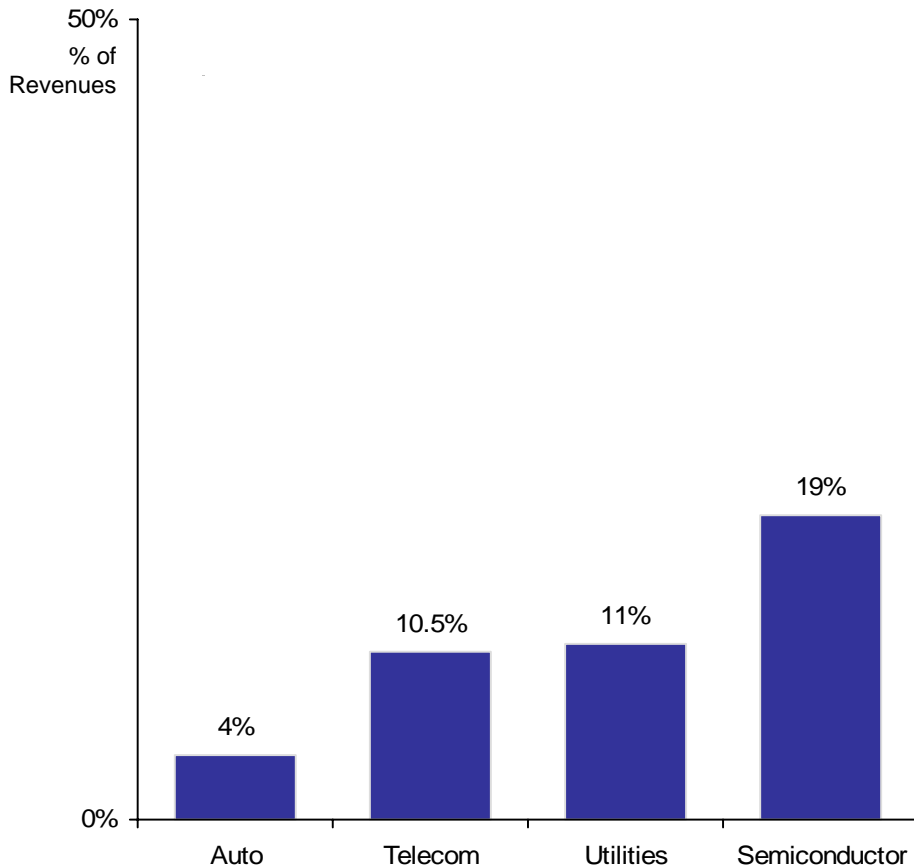


Source: Gartner Dataquest; Asaba Group Analysis

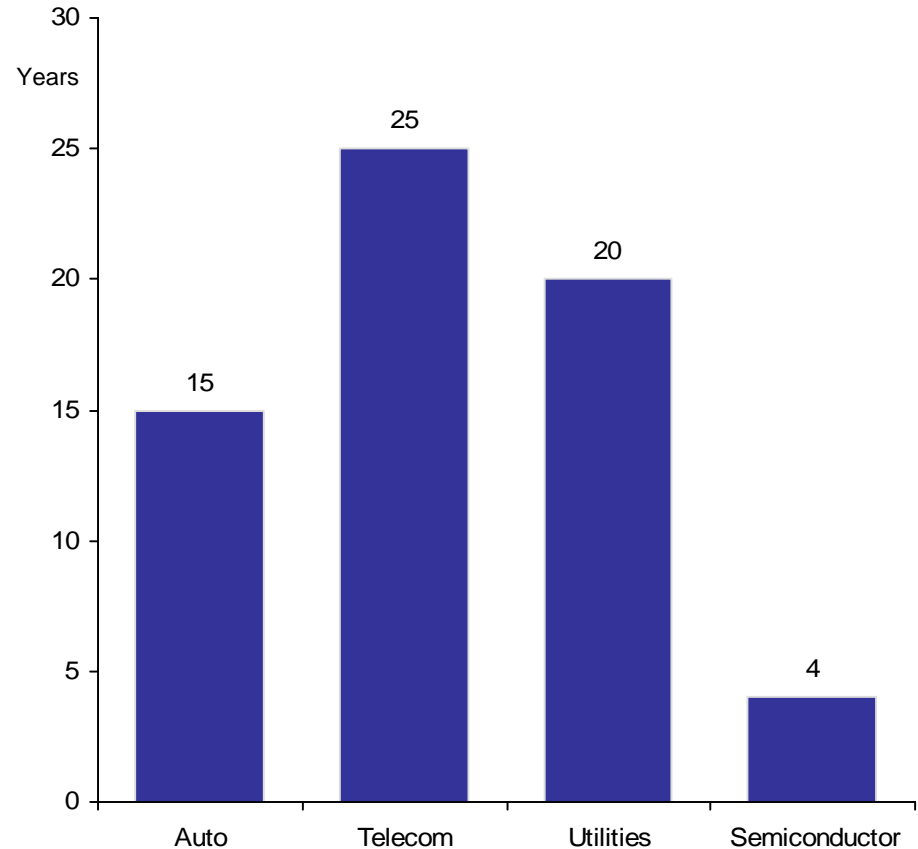
# But Industry Has High Capital Expenditure Requirements and Shorter Depreciable Asset Life

Very different from other manufacturing industries

Average Capital Expenditure  
(%) of Revenue



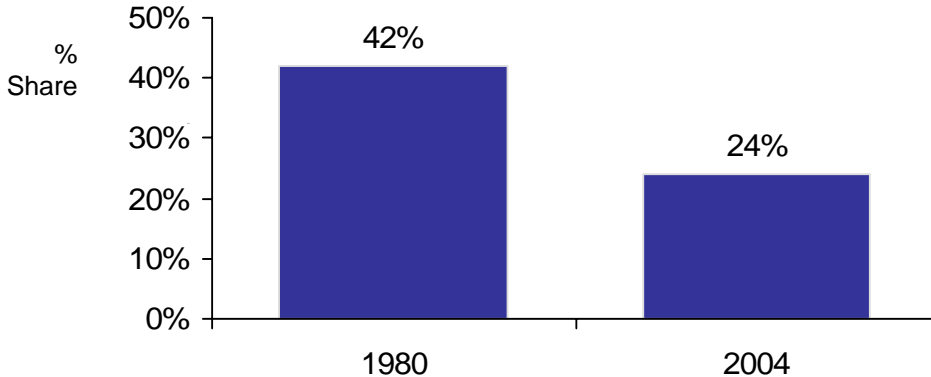
Average Depreciable Asset Life



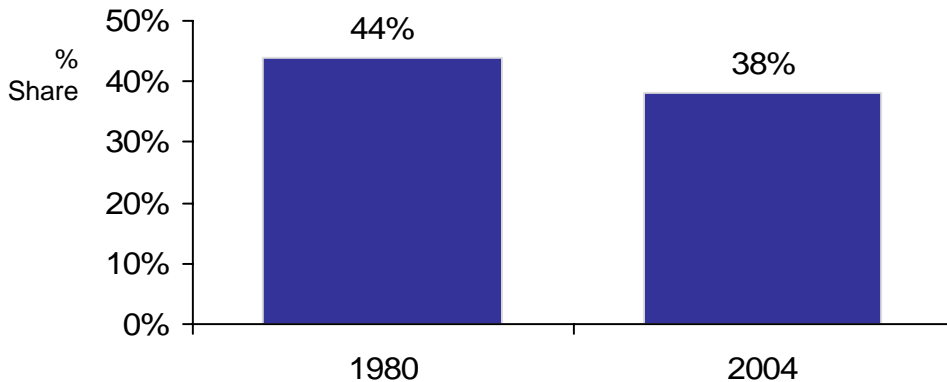
**Suppliers Must Balance Cyclicity with High CapEx and Rapid Obsolescence**

# Large Share of Domestic Chip Manufacturing Moving to Offshore Locations

**U.S. Fab Capacity Share of Global Capacity**



**Share of U.S. Ownership of Global Fabs**



## Trends and Drivers

High capital cost associated with new fabs (~\$3B)

- Strong desire to outsource chip production

Increasing specialization by industry participants has created “pure play” foundries as “fabless” manufacturers

- “Fabless” companies are forecasted to account for 50% of industry revenues by 2010

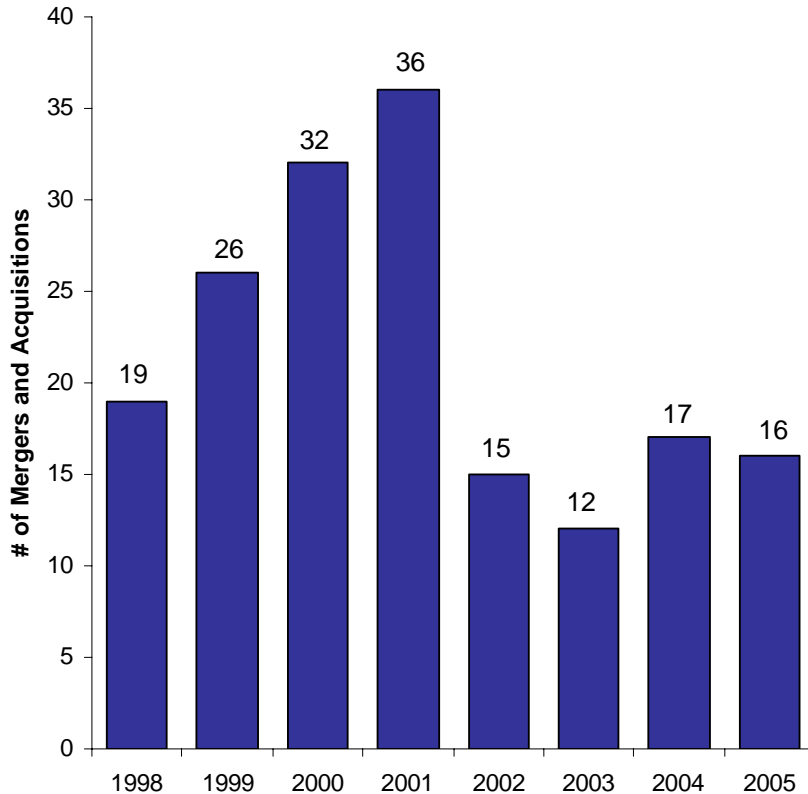
Need for low cost manufacturing drives the movement to offshore locations

- Essential in remaining competitive with other companies

**Prospective Supplier Must Have Global Focus**

# Industry Consolidation Occurring Among Equipment Manufacturers

Number of Transactions\*



## Some Recent Transactions

<u>Acquirer:</u>	<u>Target:</u>	<u>Commodity:</u>
• Applied Materials	Metron Technology	Direct Materials
• Entegris Inc.	Mykrolis Corporation	Gas/Chemicals
• BrooksAutomation	Helix Technology	Pumps
• MKS Instruments	Ion Systems Inc.	IT Systems
• Mattson Technology	Vorteck Industries	Thermal Solutions

**Diverse Supplier Should Understand Increasing Leverage With Bigger and Fewer Players**

# Implications Diverse Suppliers

## Industry Dynamics

- A. Chip consumption shifting to offshore markets
  
  
  
  
  
  
  
  
  
  
- B. Boom-Bust cycles and volatility
  
  
  
  
  
  
  
  
  
  
- C. Increase share of consumer-driven revenues
  
  
  
  
  
  
  
  
  
  
- D. Industry CapEx patterns and Moore's Law

## Implications for Supplier Diversity

- I. This requires the diverse supplier to support global scale operations or be uncompetitive
- II. Alternative is to seek equipment manufacturing domestic opportunities in the supply chain
  - Seek second tier and third tier opportunities
  
  
  
  
  
  
  
  
  
  
- I. Diverse suppliers must have resilient balance sheets and business models to ensure long-term survival
  
  
  
  
  
  
  
  
  
  
- I. OEM customer will increase demand for supplier diversity, which will lead to more opportunities for diverse businesses to become suppliers to semiconductor chip manufacturers and their equipment suppliers
  
  
  
  
  
  
  
  
  
  
- I. Diverse supplier must build leading innovation capabilities to be successful

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# Primary Supplier Selection Criteria

## Financially sound, performance, and capability to meet supply need

- “They need to be financially sound. This decreases the risk of cash flow issues. We want to know who their current customers are and what reputation does this supplier carry. They must have some degree of technical support that can work with our in-house engineers.”
- “They need to be able to bid competitively, have the correct skill sets for our needs, high quality products, and a strong reputation based on current and past customers.”
- “Our selection is based on the ability to meet our needs. We need to make sure they have the technological capability to and can provide high quality products. These products are a direct reflection of our company’s image.”
- “We need to understand who are the suppliers in our community. For chemicals, we put heavy emphasis on the supplier’s quality systems. Other factors we look into are cost, customer base, track record, and location.”

# Situations that Lead to Considering a New Supplier

Diminishing manufacturing sources, cost competitiveness, and performance

- “We may have current issues with the supplier’s service. Also, there are times when our suppliers decide a part is no longer profitable for their business. We will reopen competitive building and seek an alternative source.”
- “The procurement guys focus on cost of ownership. They look at their top spend items and try to seek more competitive prices. Also, we change our suppliers if they fail to get it done.”
- “We look for new suppliers when new technology is available. We also want long-term commitments from these new suppliers.”
- “New suppliers are considered when our fab reaches its capacity. If parts are to be delivered in a six-month or less time period, we need to seek other sources. There is just not enough time to build a new fab facility.”
- “Labor maintenance on legacy tools are potential opportunities. Once maintenance requirements expire, we are interested in seeking new suppliers with reverse engineering capabilities.”

# Key Success Factors for Diverse Suppliers

- “Potential suppliers need to have the right processes in place and have the right skill sets. This provides credibility for their services. They must also have past experience and a good reputation. They must be able to handle supply volumes and display on-time delivery.”
- “These suppliers must have a strong engineering background. They have to be aggressive and responsive to our request. They need to differentiate themselves from other companies and be innovative.”
- “Companies need to attack the mature parts areas. If they can build capabilities surrounding this area, it will help free up our fabs.”
- “In chemicals, consistency in quality levels is key to the longevity and success of our suppliers. They must have good processes in place to monitor the quality of their products.”

# Key Success Factors for Diverse Suppliers

## (Continued)

- “Suppliers need to make sure they understand what they are doing and have correct procedures in place. We want our suppliers to be productive from a longevity standpoint.”
- “Capital equipment is very specific and highly technical. I am more concerned about a new supplier’s products and what machines they can provide.”
- “The main criterion for used equipment purchasing is availability. Some machines are difficult to find and we buy from the supplier that meets this need.”
- “Chemicals is a very difficult industry to compete in. The ability to ramp up and provide continuous R&D may be challenging for small and diverse businesses.”

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# Key Takeaways

- **The semiconductor industry is relatively smaller than traditional manufacturing sectors with most growth in Asia**
  - \$213 billion global with \$39 billion in North America
- **The industry is looking to increase participation from diverse suppliers within the industry supply chain**
  - Supplier diversity program still evolving to adapt industry unique requirements
  - Sourcing opportunities with chip fabrication, equipment manufacturing, and indirect materials commodities
  - SRAC member companies spends close to \$0.5B with diverse suppliers
- **Industry has unique characteristics compared to other manufacturing sectors**
  - Diverse suppliers must be well capitalized and have access to adequate financing sources to fund innovation and weather industry cycles/volatility
  - Diversified revenue sources for indirect material suppliers is highly recommended
  - Innovation is a strong competitive differentiator
  - Supplier seeking to support direct input material requirements must have a global focus to be competitive
- **The semiconductor equipment manufacturing supply chain has the best second and third tier opportunities for small, innovative manufacturing suppliers**

# Key Takeaways

(continued)

- **Strong industry domain knowledge is a critical success factor for diverse suppliers**
  - Getting access to proprietary expertise improves competitiveness and becomes a barrier to switching suppliers
  - Industry participants are very competitive and require suppliers to have innovation contained within their value proposition
    - Less so compared with efficiency and cost savings

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