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# What's Going to Rock Your World

or at least push your probes.

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Research  
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6/06/10

# Agenda

- What will drive the industry?
- How will that impact the semiconductor forecast?
- What does it mean for manufacturing?
- What can I say about test?
- Conclusions.

**The hot technology of the decade will be unexpected, yet they are incubating right now.**





■ ■ ■ ■ How do we predict what will  
be hot this decade?

# Gartner's Top 10 Technologies for 2010

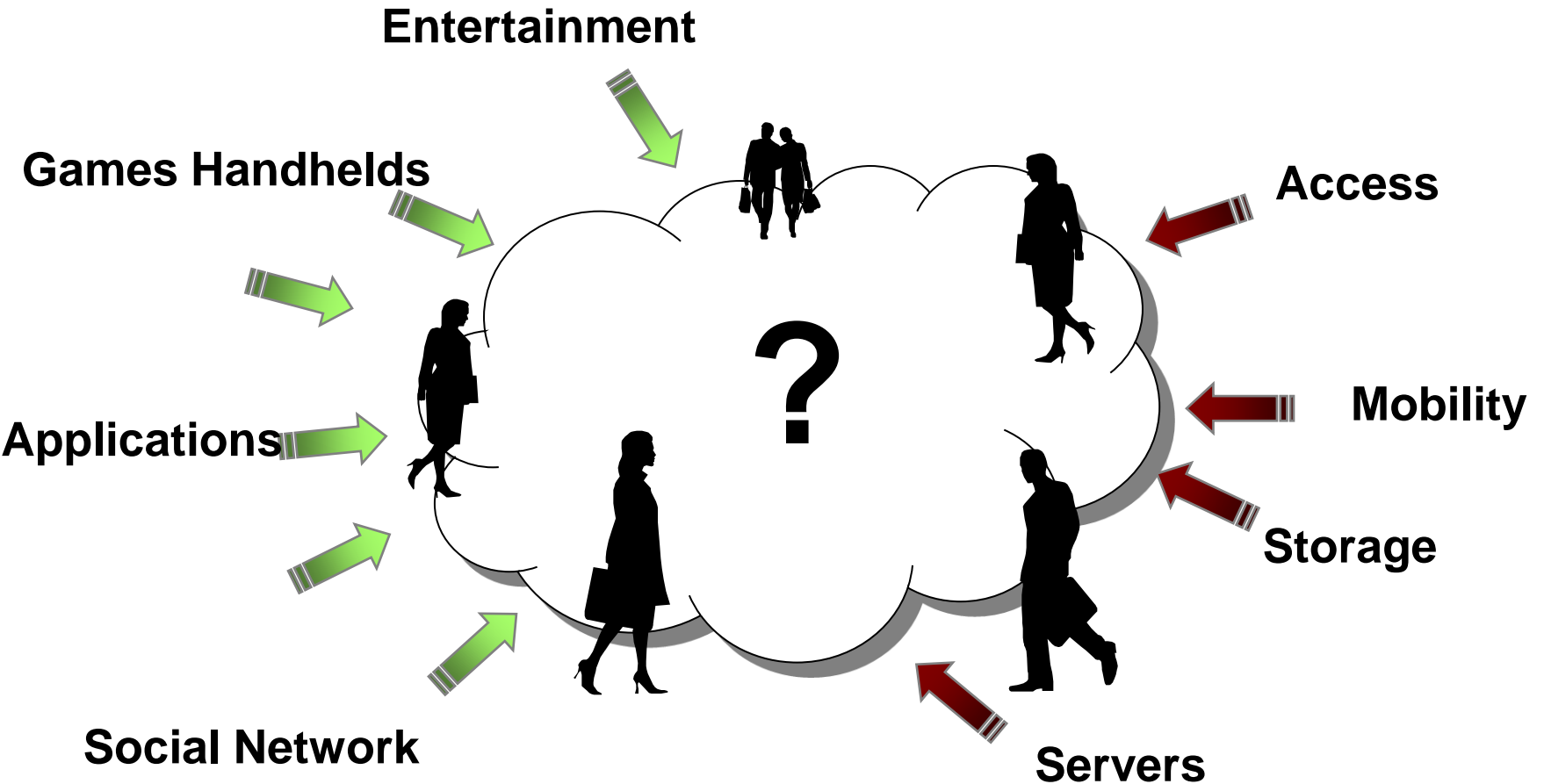
- Cloud Computing
- Advanced Analytics
- Client Computing
- Green IT
- Reshaping the Data Center
- Social Computing
- Security-Activity Monitoring
- Flash Memory
- Virtualization for Availability
- Mobile Applications



# What are 3 Key Technology Trends that will Drive Technology in the Teens?

- Cloud Computing
- Green Tech/IT
- Social Computing

# What will the cloud be like?



# Effects of Cloud on Semiconductor Sectors

|     |                                       |
|-----|---------------------------------------|
| +   | Servers                               |
| -   | Mainstream PCs                        |
| +++ | Low-end PCs / Mini-Notebooks          |
| +++ | Smartphones                           |
| ++  | Mobile Network Infrastructure         |
| +   | Fixed Network Infrastructure          |
| ++  | Security technology (e.g. Encryption) |
| +   | Storage Infrastructure                |
| -   | Client storage                        |
| +   | Consumer devices                      |
| +   | Overall semiconductors                |



# Changes in the Energy Picture



# What Technology Will it Drive

- Smart Meters
- Software
- Unique Devices
  - Analog, MEM's Microcontrollers
  - CPU, MPU, Memory with lower energy usage
  - LED's
  - Energy Storage
    - Battery technology

# Social Networking

**Twitter**

**Linked-in**

**Plaxo**

**Face Book**

**Blogging**

# What Technology will SN Drive

- Network enabling devices
  - Smart Phones
  - Tablets
- Mobile infrastructure
  - Wireless, Broadband
- Applications
- Security

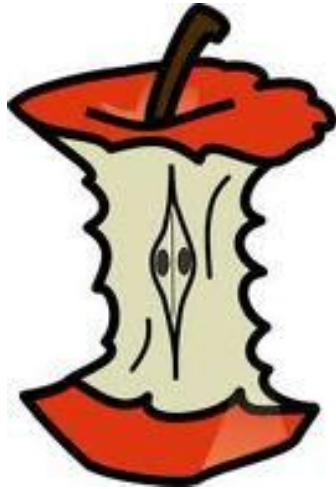


# What Technologies will emerge

- Mobility
- Security
- Smart devices
- Storage

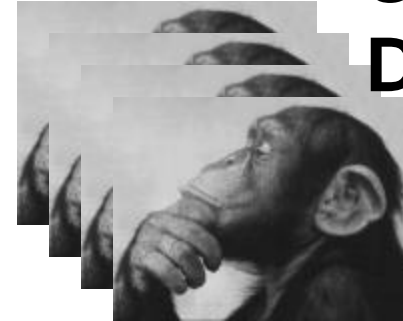
# What devices will these technologies drive?

**cores**



**ASSP**

**Storage/  
Memory**



**Stacked  
Die**

**Power**

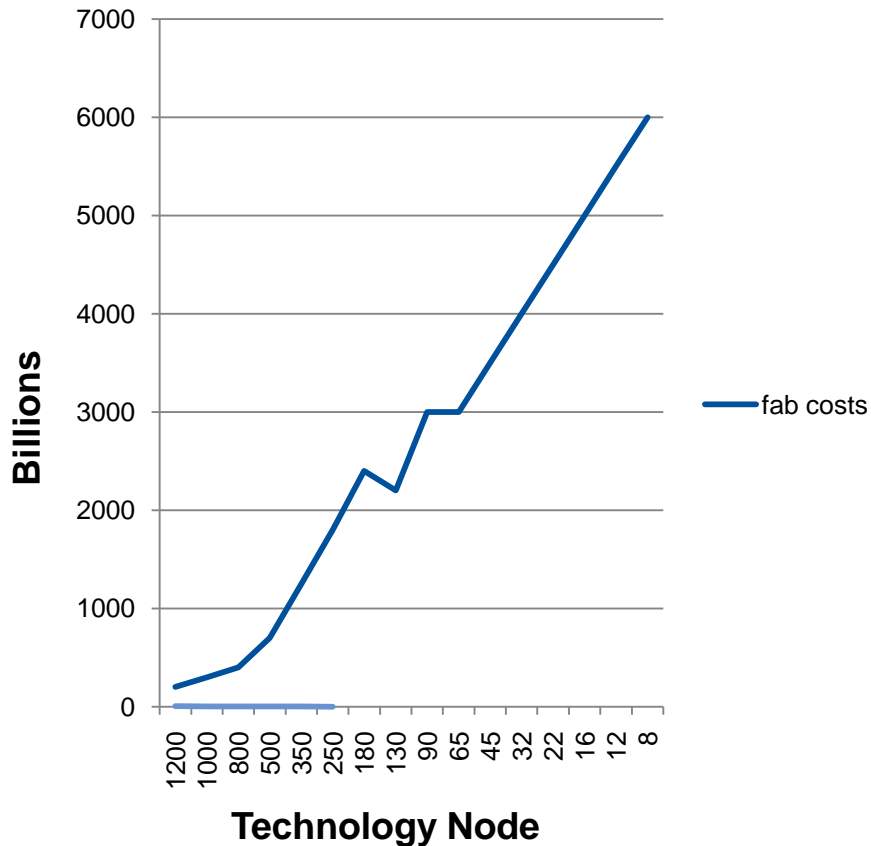




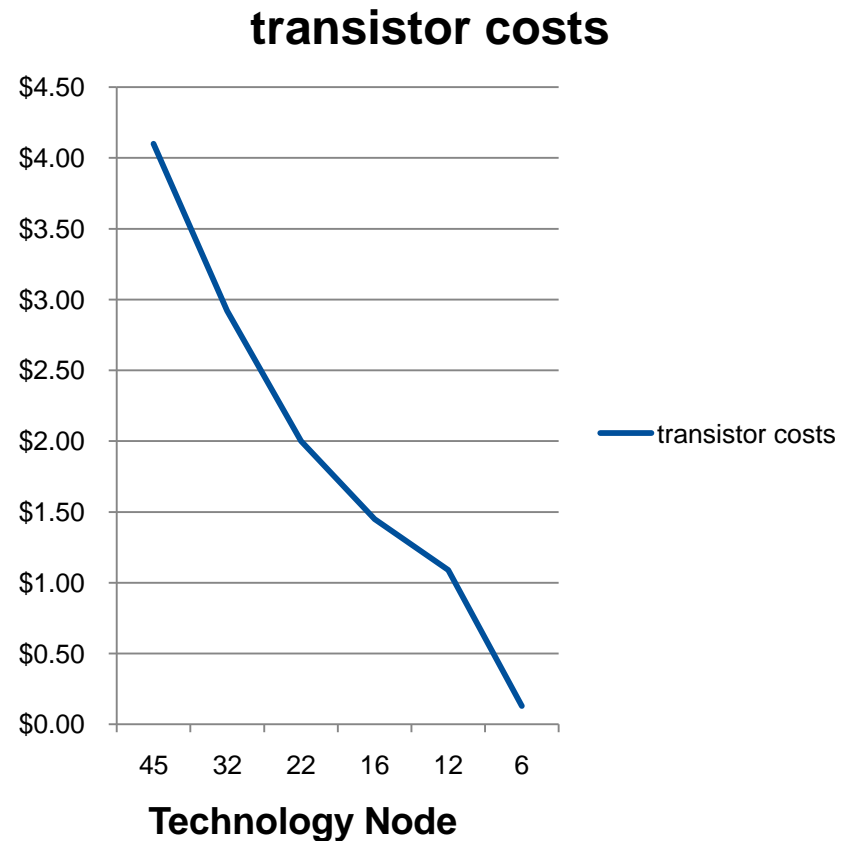
# ■ ■ ■ ■ The Impact on the Industry

# Moore's Law Alive and Well

## Fab Costs



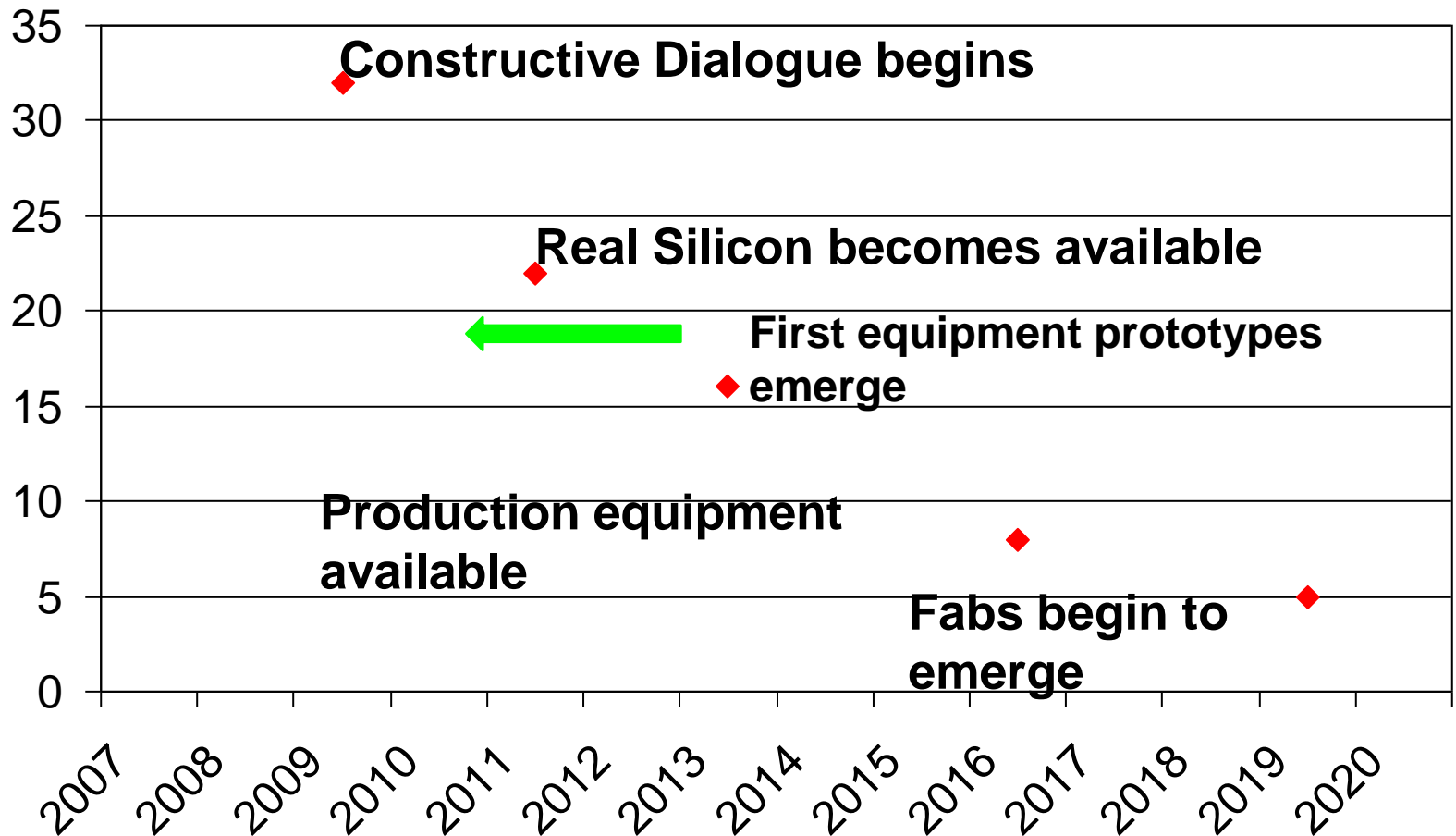
## Transistor Costs





# The 450 mm wafer time-line

## Line width nm

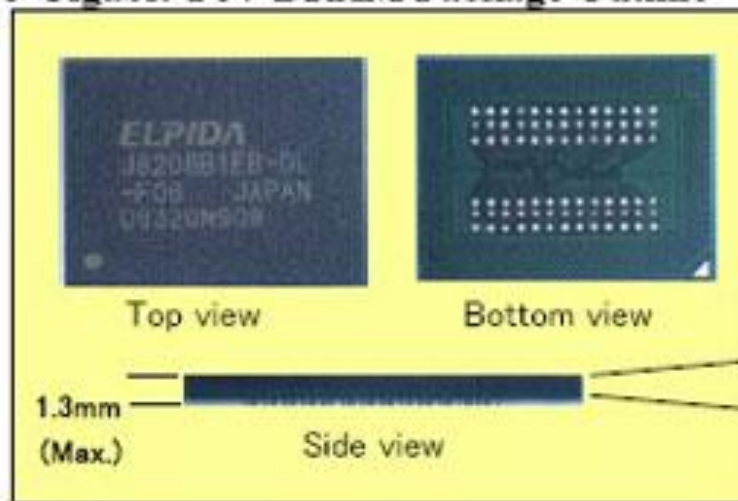


# TSV

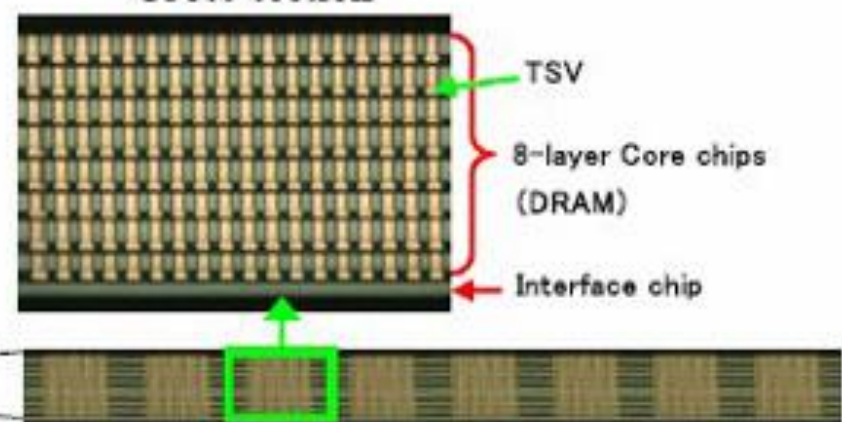
- Install production capacity at its Hiroshima plant.
- Production Start Q1 2010; 300 mm, 10K wpm

Elpida 8 Gb DRAM product with eight die connected by TSVs.

8-Gigabit TSV DRAM Package Outline



Cross-section



Via-last (backside) process flow with copper metallization. Cu pillars for front side bumps. Cu-Cu bonding possible. Low-temp SiO<sub>2</sub> for TSV isolation. Temperature restriction on the process is determined by the stability of the temporary glue layer on the carrier wafer. Front side pillar bumps fabricated before wafer attach to carrier for thinning. Wafer thickness will be ~30 μm.

Stacking method is die-to-die.



# ■ ■ ■ ■ The Semiconductor Forecast

# How Strong is the Recovery?

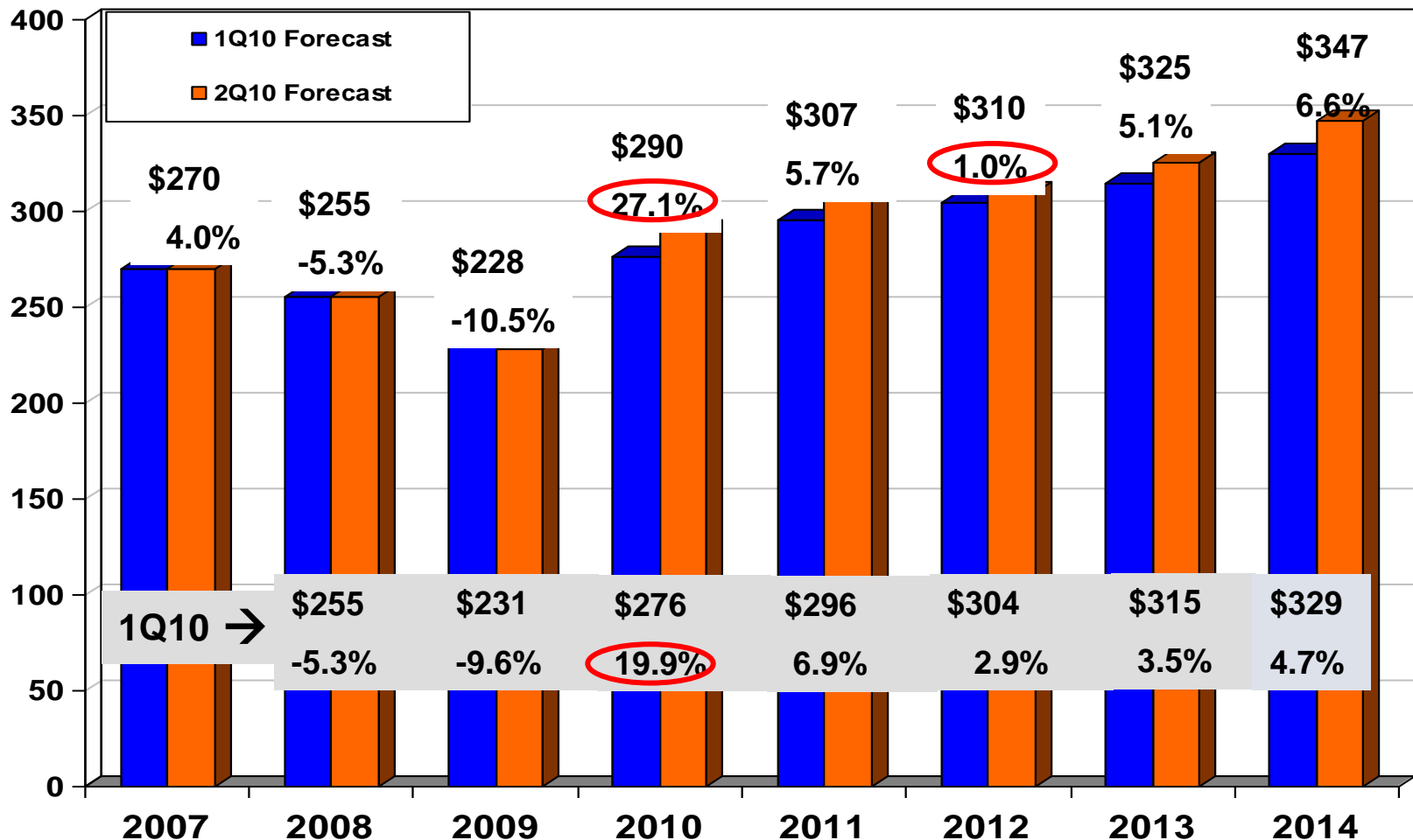
- GDP strengthening threat of W fading away
- Dollar Stronger as US economy improves
- Emerging economies leading the way.
- Established economies improving rapidly, Europe is a bit slow
- Consumers spending at a rapid rate
- Demand is improving
- Manufacturing indexes keep improving
- Supply Chains are stretched thin but not breaking
- Current concerns
  - Gov. Debt will be an issue for the foreseeable future
  - Commercial Real Estate
  - Unemployment still lingers
  - Europe/Greece crisis – will it go away?





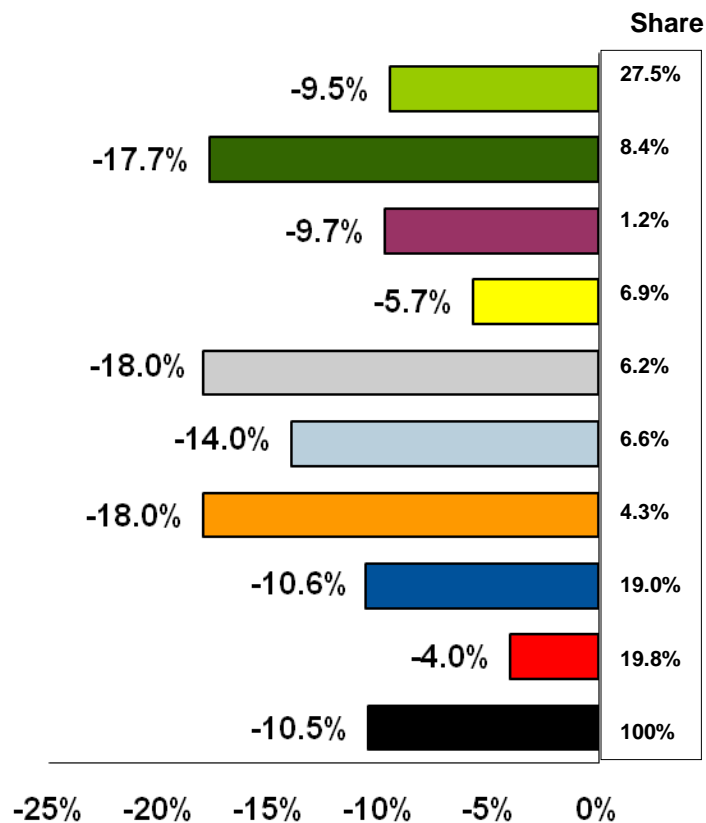
# Worldwide Semiconductor Revenue Forecast: Significant Improvement in 2Q10 Update

Billions of Dollars and Revenue Growth

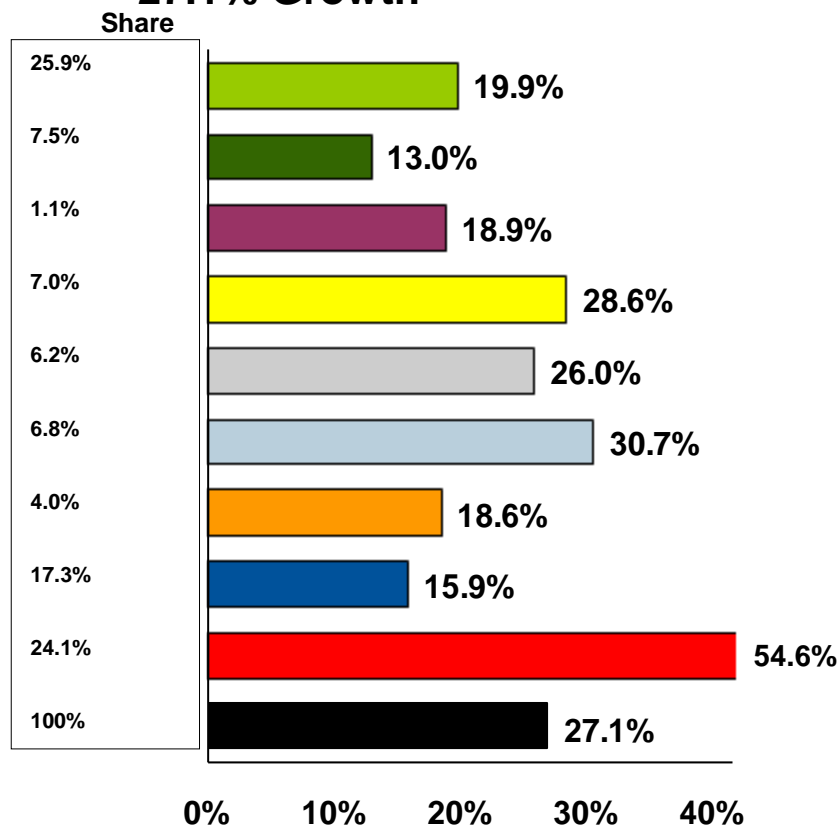


# Worldwide Semiconductor Forecast, 2Q10: Market Growth by Device, 2009 and 2010

**2009 Revenues \$228 Billion**  
**-10.5% Growth**



**2010 Revenues \$290 Billion**  
**27.1% Growth**



Source: Gartner, June 2010

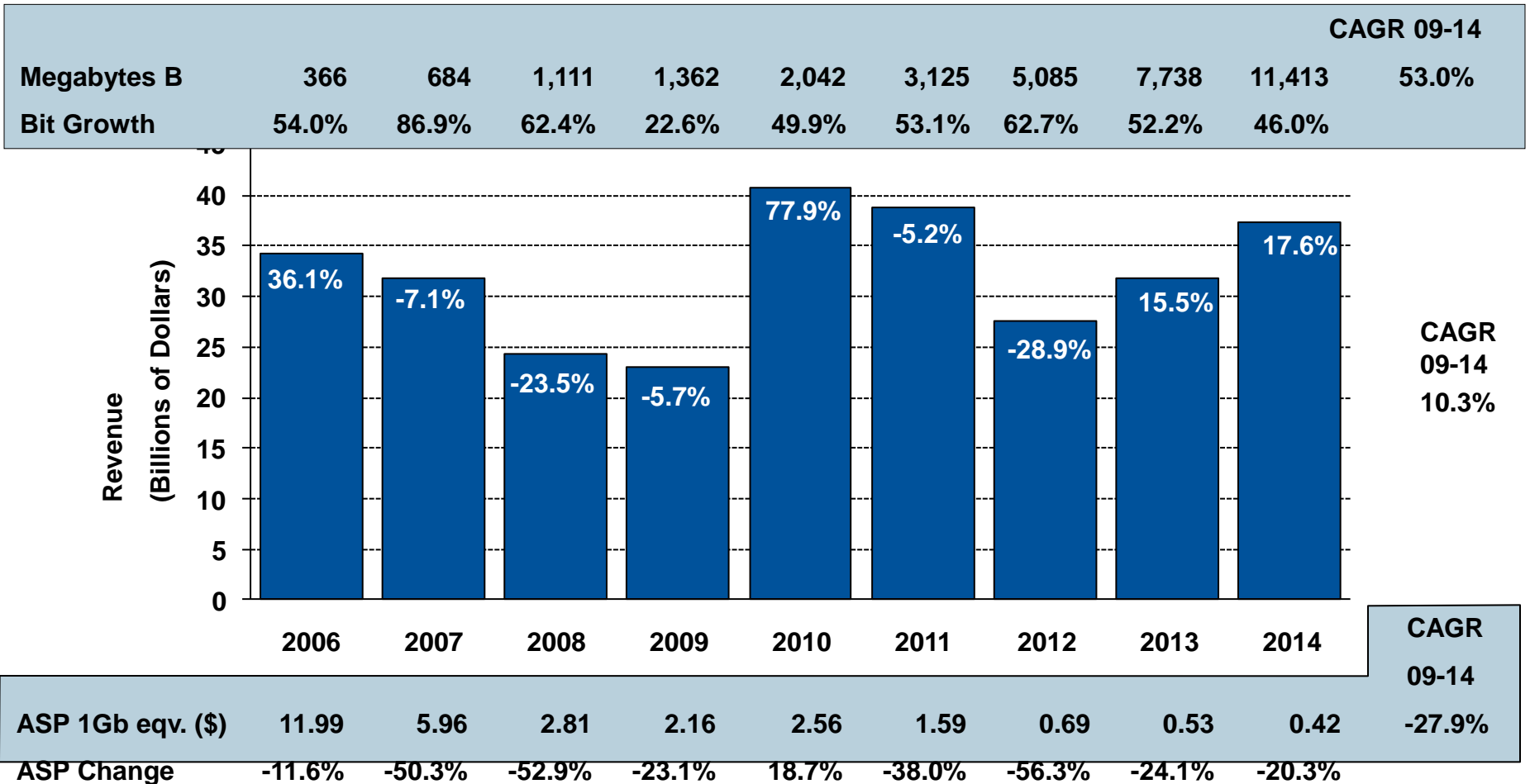
Semiconductor Forecast Worldwide--Forecast Database [SEQS-WW-DB-DATA]

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# Broad-based Recovery Driving 2010 Upside (2Q10 versus 1Q10 Forecasts)

| <b>Applications</b>       | <b>2010 Change from Last Quarter (\$B)</b> | <b>% of Total</b> |
|---------------------------|--|-------------------|
| PCs & Cell Phones         | 3.76                                       | 27.3%             |
| Automotive                | 1.66                                       | 12.1%             |
| TV, LCD                   | 1.11                                       | 8.1%              |
| All Other Applications    | 7.22                                       | 52.5%             |
| <b>Total Applications</b> | <b>13.75</b>                               | <b>100.0%</b>     |

# DRAM Forecast, 2Q10: Annual DRAM Market Metrics



Source: Gartner, May 2010

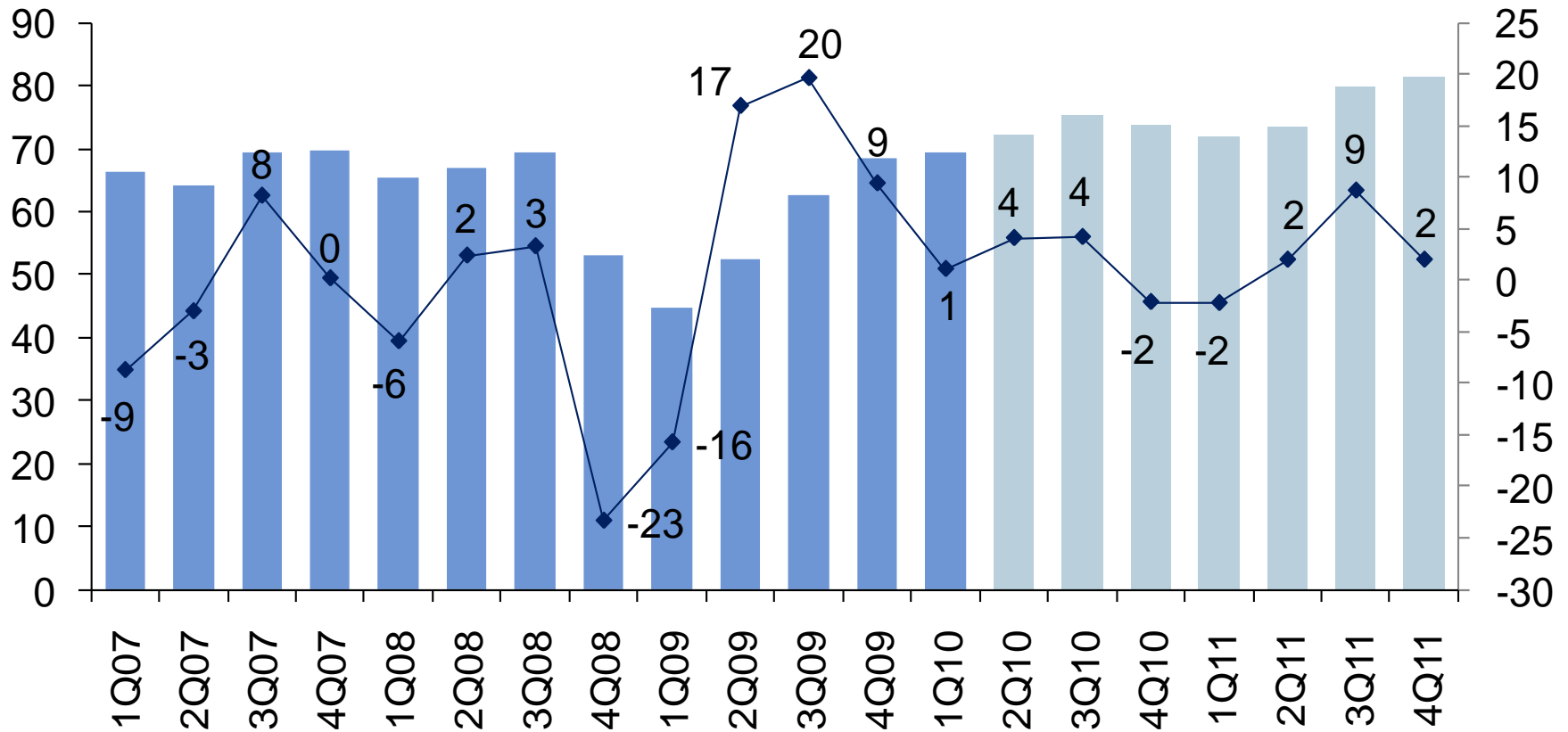
"Forecast: DRAM, Market Statistics, Worldwide, 2004-2014 (2Q10 Update)"



# Worldwide Semiconductor Forecast, 2Q10: Quarterly Growth Profile

Revenue (\$B)

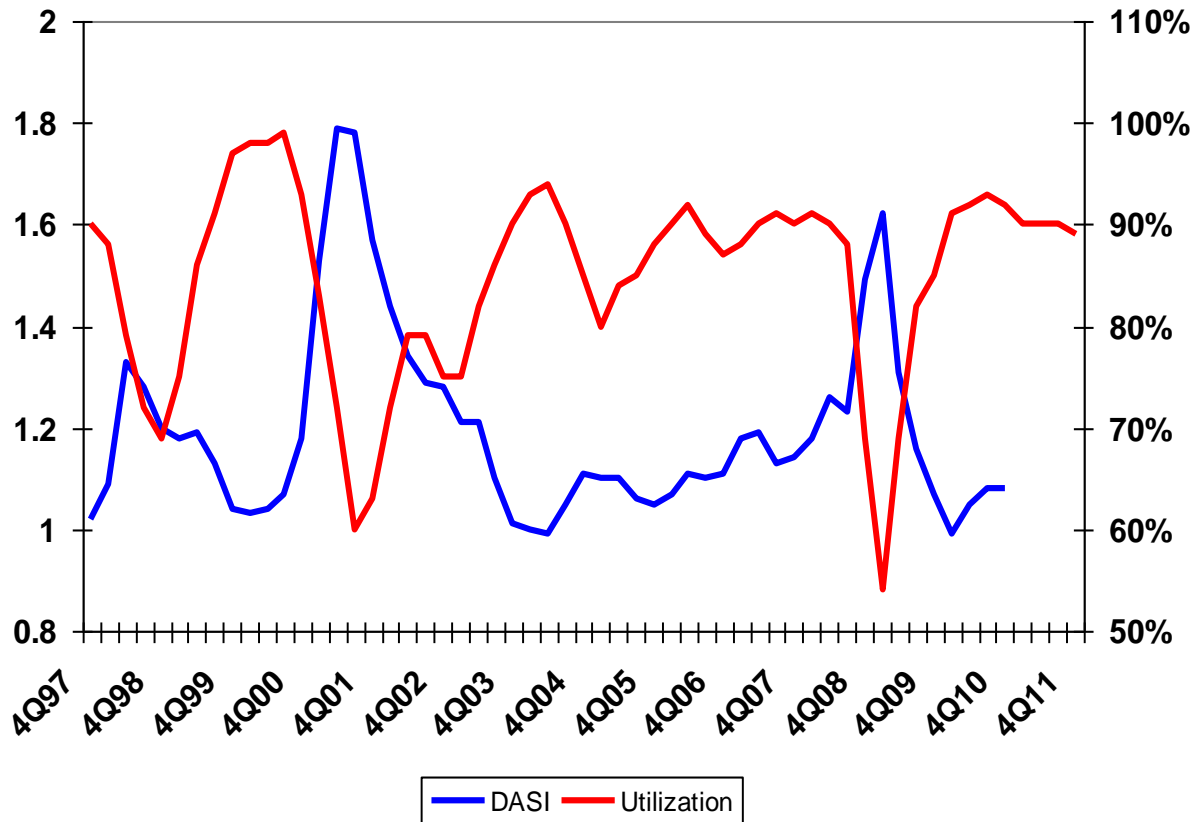
Quarterly Sequential Growth (%)



# Inventory Index vs. Utilization: Inventories in Control as Utilization Rises

DASI

Utilization



- Utilization rises in response to strong Semiconductor demand
- Inventories stay in ideal range as production synchs up with demand
- Hi investments in new capacity in 2011 drop utilization rates as DRAM oversupply develops

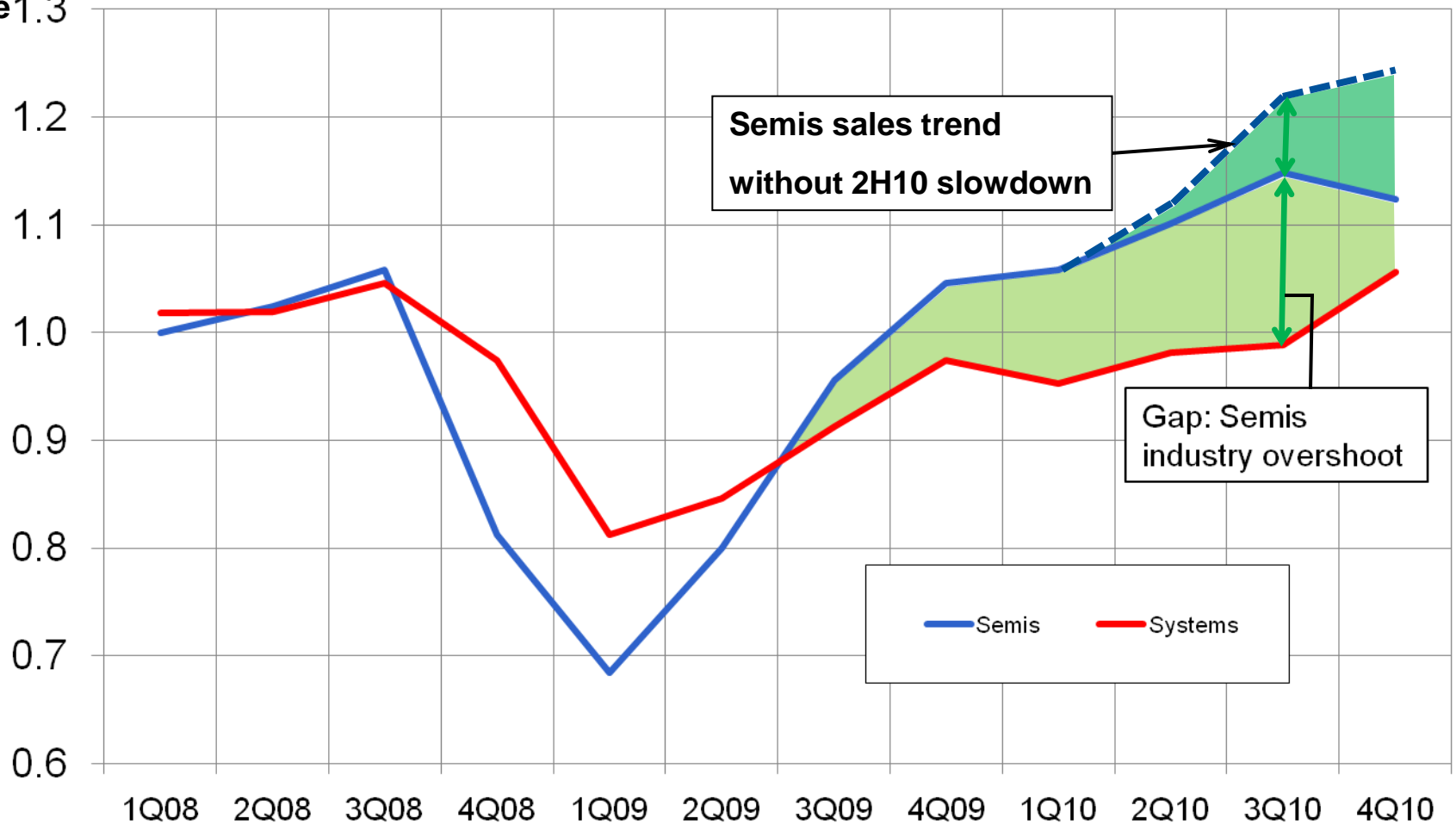
Source: Gartner Estimates (March 2010)

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# Semiconductor Revenue Running Ahead of Systems Revenue

## New Gartner Index – Preliminary

Normalized  
Revenue



# Conclusions

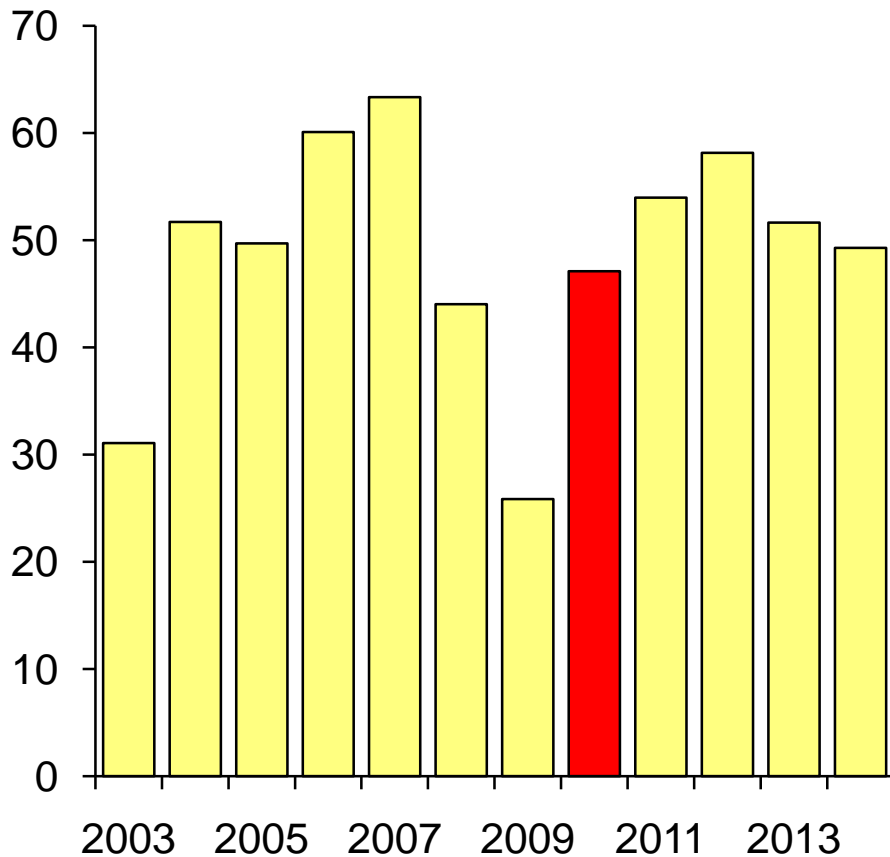
- Semiconductor revenue is poised to hit record levels in 2010
- Most-likely 2010 growth 27%, best-case scenario 30%+
- Recovery is widespread with most applications and regions experiencing an increase in orders
- DRAM fastest growing device type in 2010
- Modest chip correction programmed in back-half 2010 and into 2011 as semiconductor growth re-aligns with system growth



# ■ ■ ■ ■ Wafer Fab Equipment

# Capital Spending: Growth Returns in 2010 – but Risks

Billions of Dollars



- **2010 Spending up ~80% driven by move to 4x and 3xnm capabilities**
- **New capacity spending begins in earnest in 2011**
- **Current DRAM forecast shows weak 2012 – capex peak could be pulled into 2011**



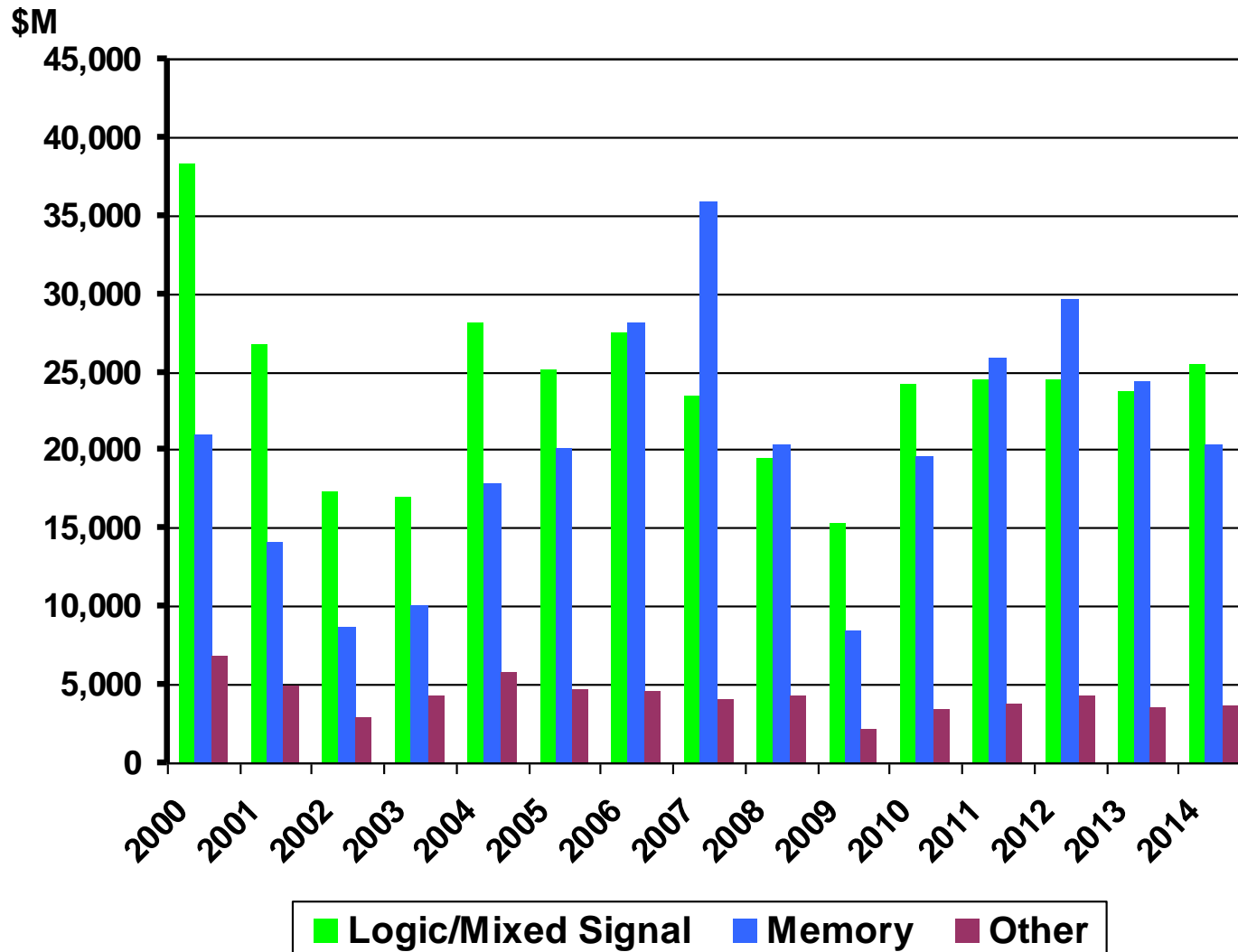
# 2010 Capex Top 20: Strong Growth Across the Board

\$M

| 2010 Rank | Company                                 | 2009            | 2010            | Change (%)  | Share (%)    |
|-----------|---|-----------------|-----------------|-------------|--------------|
| 1         | Samsung                                 | 3,900.0         | 9,600.0         | 146.2       | 20.4         |
| 2         | TSMC Group                              | 2,671.0         | 5,250.0         | 96.6        | 11.1         |
| 3         | Intel                                   | 4,500.0         | 4,900.0         | 8.9         | 10.4         |
| 4         | Globalfoundries                         | 550.0           | 2,600.0         | 372.7       | 5.5          |
| 5         | Hynix Semiconductor                     | 784.0           | 2,200.0         | 180.6       | 4.7          |
| 6         | Toshiba                                 | 910.9           | 2,172.9         | 138.5       | 4.6          |
| 7         | Inotera Memory                          | 400.0           | 1,634.0         | 308.5       | 3.5          |
| 8         | United Microelectronics Group           | 551.0           | 1,350.0         | 145.0       | 2.9          |
| 9         | Texas Instruments                       | 800.0           | 900.0           | 12.5        | 1.9          |
| 9         | SanDisk                                 | 370.0           | 900.0           | 143.2       | 1.9          |
| 11        | Elpida Memory                           | 443.3           | 874.6           | 97.3        | 1.9          |
| 12        | Micron Technology                       | 500.0           | 800.0           | 60.0        | 1.7          |
| 13        | Nanya Technology                        | 446.0           | 780.0           | 74.9        | 1.7          |
| 14        | Rohm                                    | 402.8           | 621.4           | 54.3        | 1.3          |
| 15        | IBM Microelectronics                    | 375.0           | 575.0           | 53.3        | 1.2          |
| 16        | Renesas Electronics (formerly NEC)      | 317.8           | 571.5           | 79.8        | 1.2          |
| 17        | Advanced Semiconductor Engineering      | 386.9           | 515.0           | 33.1        | 1.1          |
| 18        | STMicroelectronics                      | 451.0           | 500.0           | 10.9        | 1.1          |
| 19        | Siliconware Precision Company (SPIL)    | 161.0           | 449.0           | 178.9       | 1.0          |
| 20        | Sony                                    | 330.0           | 419.4           | 27.1        | 0.9          |
|           | <b>Top 20 Companies Total*</b>          | <b>19,250.8</b> | <b>37,612.7</b> | <b>95.4</b> | <b>79.8</b>  |
|           | <b>Total Worldwide Capital Spending</b> | <b>25,876.3</b> | <b>47,118.5</b> | <b>82.1</b> | <b>100.0</b> |
|           | <b>Top Companies (Percent)</b>          | <b>74.4</b>     | <b>79.8</b>     |             |              |

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# Capital Spending by Device Type





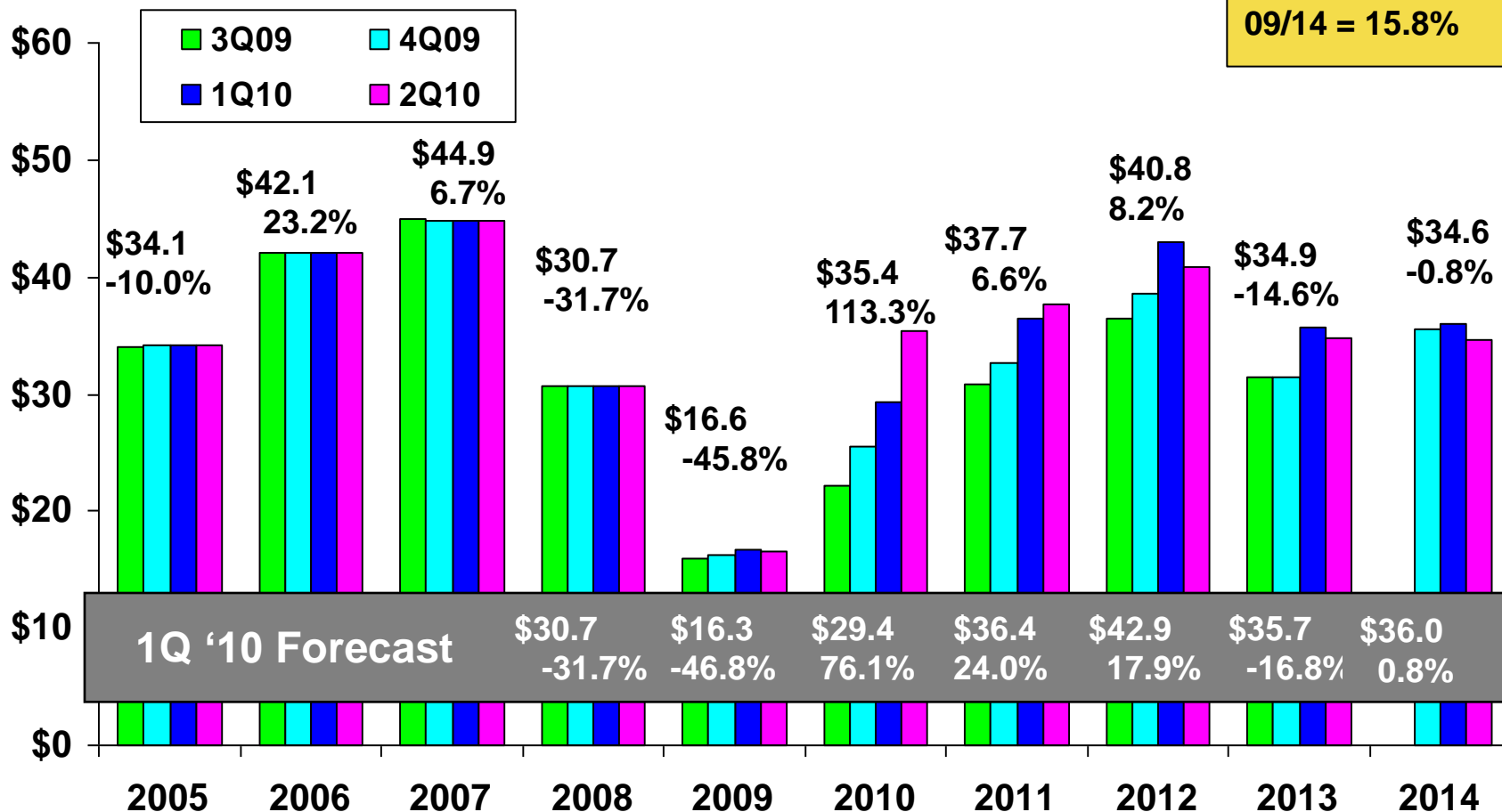
# Who's Building Fabs?

| In Progress/Tech Upgrade | Empty Shell   | New Fabs      |
|--------------------------|---------------|---------------|
| Intel                    | IM Flash      | Toshiba F5    |
| GF Dresden/7             | TSMC 12/14    | TSMC 12/14/15 |
| Toshiba Fab 4            | Samsung 14/15 | Samsung 16    |
| TSMC 12/14               | Catania       | GF Malta      |
| Nanya/Inotera            | Rex Chip 2    |               |
| IM Flash Lehi            | MeiYa         |               |
| Samsung                  |               |               |
| Elpida                   |               |               |
|                          |               |               |

# Semiconductor Capital Equipment, 1Q 10: Strength Through 2012, then Retrenchment

Billions of Dollars and Revenue Growth  
All Capital Equipment Including Test

Revenue CAGR  
09/14 = 15.8%



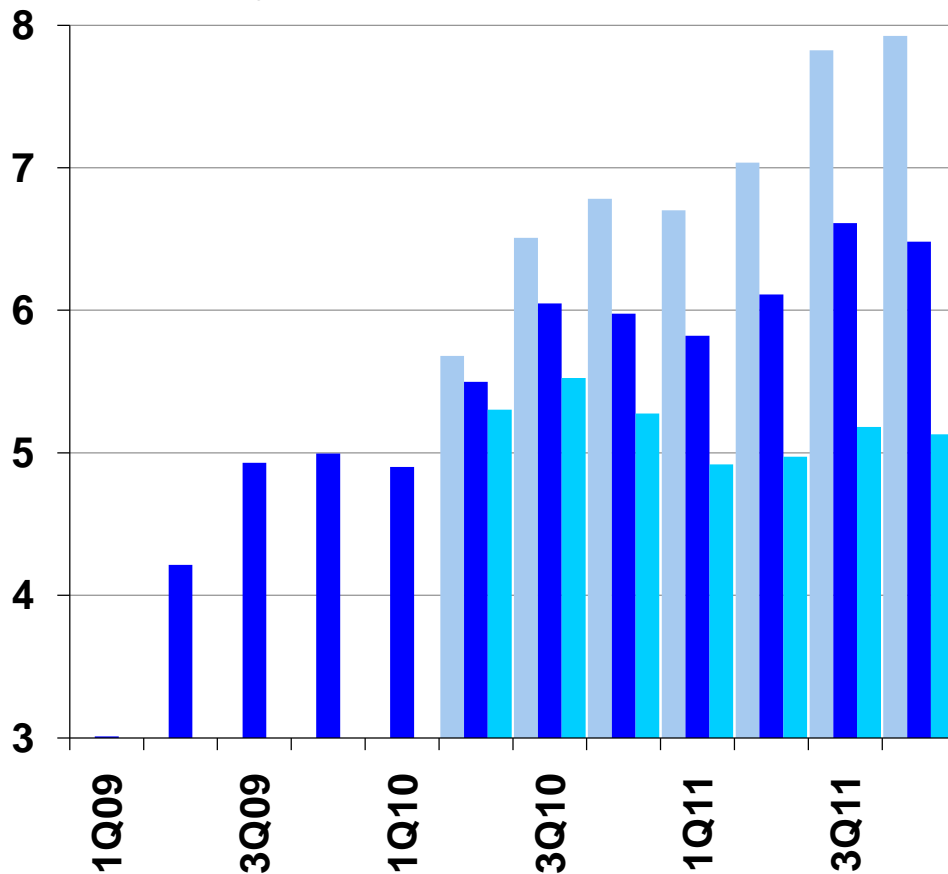




# ■ ■ ■ ■ Test Forecast

# SATS Market: Quarterly Revenue Forecast Scenarios

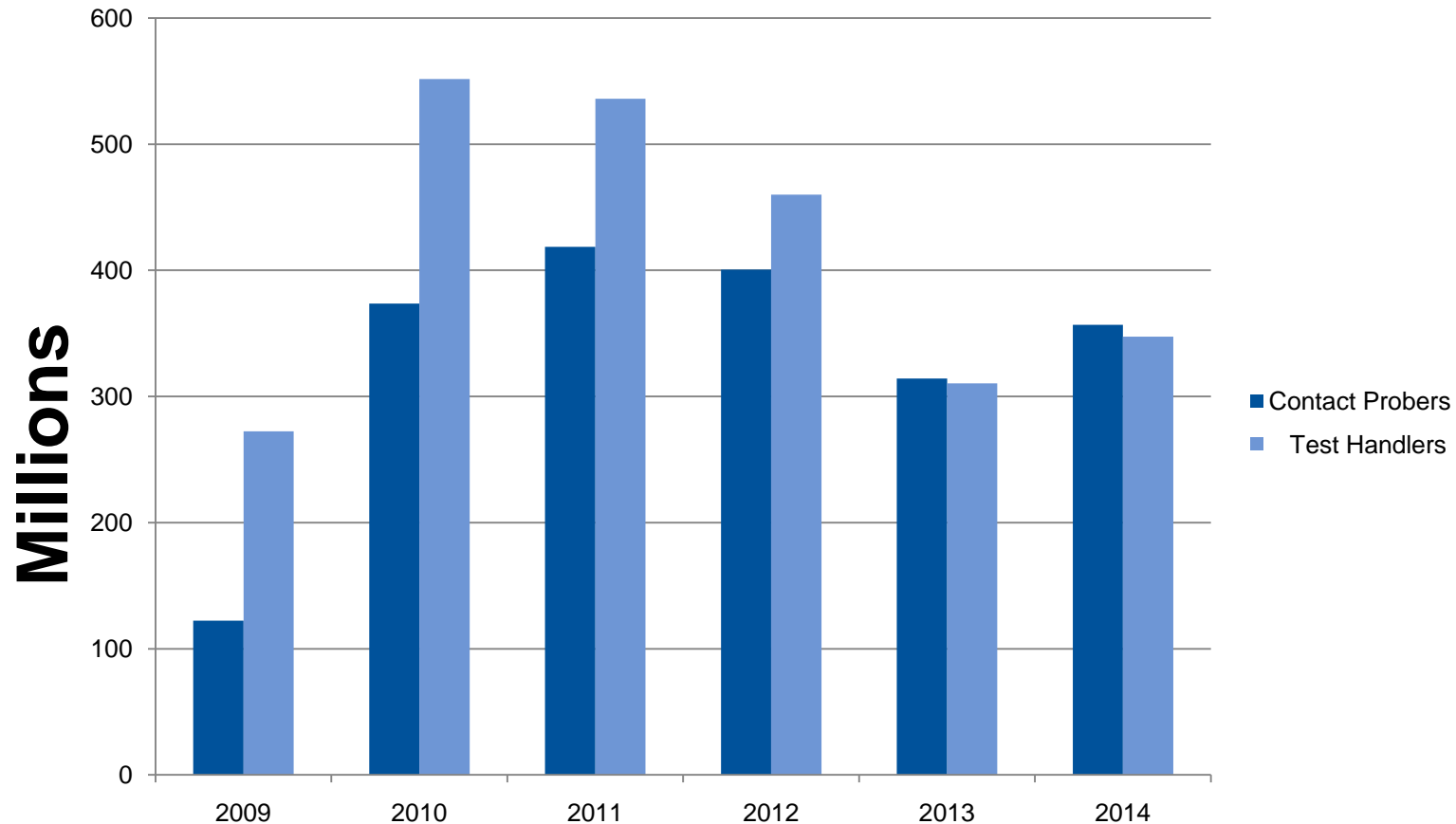
Quarterly Revenue (Billions of Dollars)



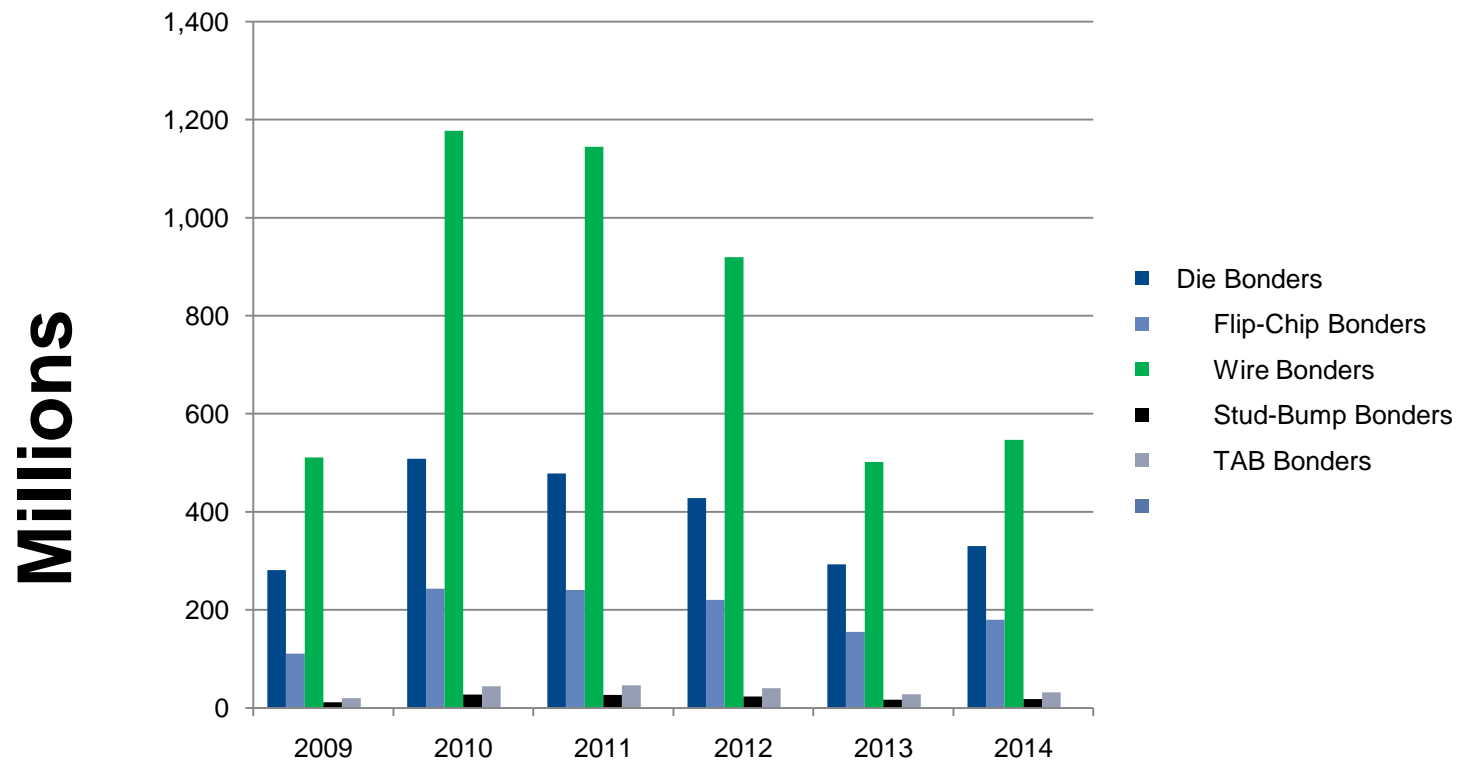
- After declining 14.7% in 2009, the SATS market should expand by 30.8% this year.
- Industry capacity utilization is now above 85% (90% for the leading edge), increased utilization is expected for the next few quarters.
- SATS vendors focusing on advanced packaging and test offerings to grow the balance sheets top line. Memory capacity will be a focus for this year.



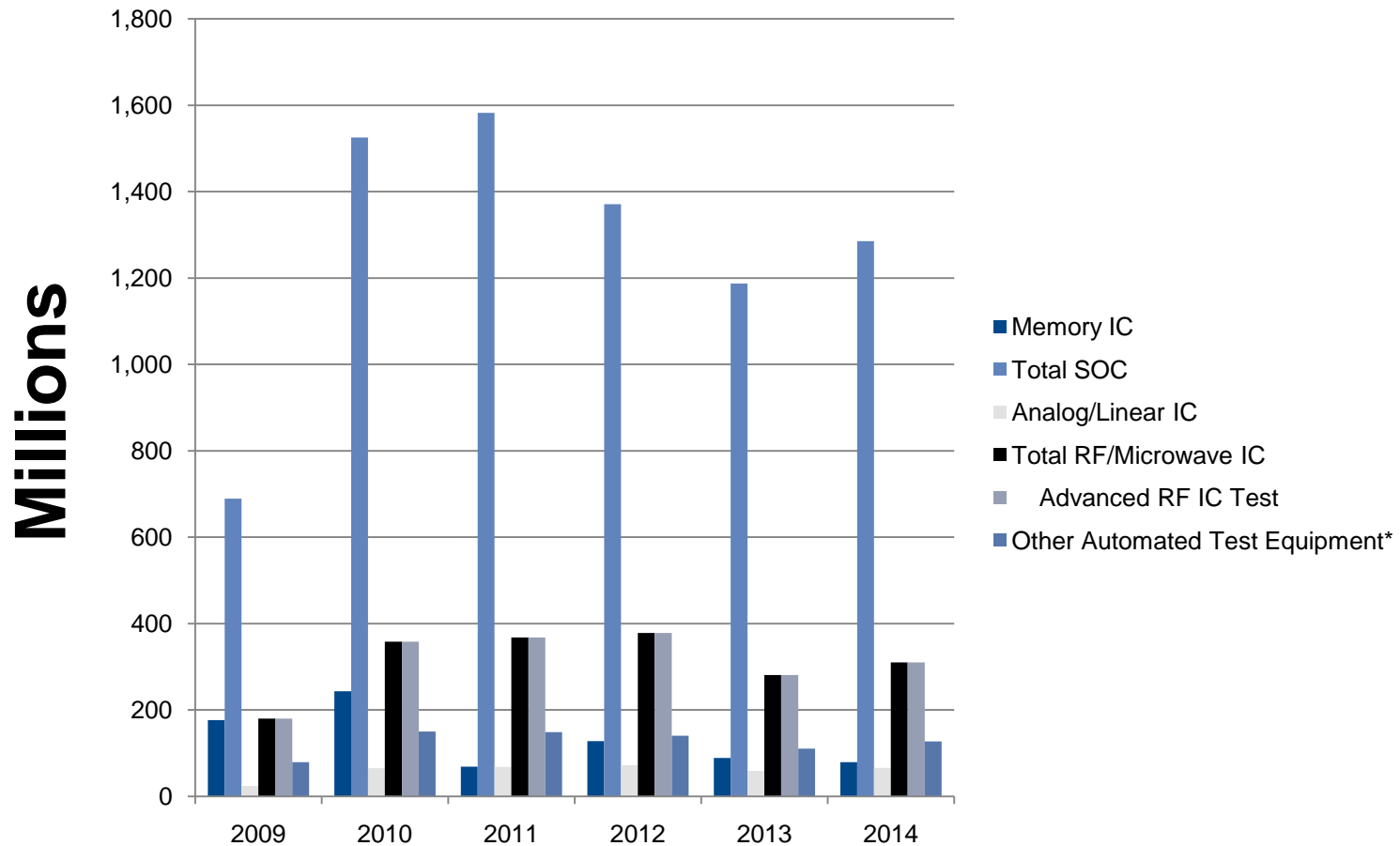
# Probe and Test Handler Forecast



# Bonder Forecast



# Test Forecast





# Forecast Growth Scorecard

| Revenue Growth (%)           | 2009   |        |       | 2010   |        |        |
|------------------------------|--------|--------|-------|--------|--------|--------|
|                              | -6 Mos | -3 Mos | Now   | -6 Mos | -3 Mos | Now    |
| Global Real GDP              | -2.2   | -2.1   | -2.0  | +2.7   | +3.0   | +3.5   |
| U.S. Real GDP                | -2.5   | -2.4   | -2.4  | +2.2   | +3.0   | +3.5   |
| Elec. Equipment <sup>1</sup> | -12.2  | -11.3  | -10.7 | +4.8   | +8.6   | +12.2  |
| Semiconductor <sup>2</sup>   | -11.4  | -9.6   | -10.5 | +13.0  | +19.9  | +27.1  |
| Foundry                      | -12.0  | -11.6  | -11.2 | +25.1  | +30.2  | +37.8  |
| SATS                         | -9.3   | -14.5  | -14.7 | +21.5  | +26.2  | +30.8  |
| Capital Spending             | -42.6  | -41.1  | -41.2 | +45.3  | +55.9  | +83.5  |
| Equip. Spending              | -46.8  | -45.6  | -45.8 | +56.3  | +76.1  | +113.2 |
| WFE Equipment                | -48.1  | -46.4  | -47.4 | +56.6  | +76.7  | +113.3 |
| P&A Equipment                | -40.5  | -40.4  | -32.3 | +52.8  | +75.7  | +104.7 |
| AT Equipment                 | -44.9  | -46.1  | -53.0 | +59.7  | +72.0  | +133.1 |
| Silicon (MSI)                | -18.2  | -17.7  | -17.0 | +23.4  | +29.5  | +34.3  |

<sup>1</sup> Production revenue

<sup>2</sup> Excluding solar

Source for GDP data: IHS Global Insight

Source: Gartner (June 2010)

# Wrapup

- Semiconductor industry is back on track and back on cycle
- The Cloud and Social Networking will drive the need for better mobile devices and a higher degree of security.
- Core, and stacked devices make the test challenge even greater.
- The Industry will continue to rock through 2012, roll while you can.



■ ■ ■ ■ Questions?