Dataquest Predicts

Semiconductor and Electronics Manufacturing Predictions for 2003

Abstract: 2002 was a second dismal year for the semiconductor and electronics manufacturing industry. What promise does the new year hold?

By Klaus Rinnen, Jim Hines, Jim Walker, Bob Johnson, Dean Freeman, Dorothy Lai, Adriana Blanco, Jamie Wang, Reiko Tomasch, Philip Koh and Kay-Yang Tan

Strategic Planning Assumptions

The EMS industry will see a mild upturn in 2003 in line with a recovery for electronic equipment (0.9 probability).

Foundry sales revenue will gradually re-accelerate for an annual expansion of 23 percent in 2003 (0.8 probability).

Excess capacity in the SATS industry for mature packages will likely remain for the duration of 2003 (0.8 probability).

Technology purchases of WFE will continue to dominate until the latter half of 2003 (0.9 probability).

Overall fab utilization will climb gradually to almost 90 percent through 2003 (0.8 probability).

Fewer than five semiconductor manufacturing plants in China will start production in 2003 (0.9 probability).

A significant portion of the low-end, high-volume semiconductor manufacturing facilities in Southeast Asia will be lost to China by the end of 2003 (0.7 probability).

Taiwan semiconductor production revenue will grow by more than 10 percent in 2003 (0.7 probability).

Publication Date: 13 January 2003
Introduction

2002 is over, and with it a second dismal year comes to an end for the semiconductor manufacturing industry and its suppliers. As we enter 2003, a high degree of uncertainty remains for what the new year will bring. It should be no surprise that the outlook for the electronics and semiconductor markets in 2003 is no clearer but more modest today than it was three months ago. But all is not lost. The fog of uncertainty should lift in 2003.

Gartner Dataquest expects gradual economic improvements throughout 2003, leading to a revival of business confidence and spending, albeit at varying rates. Nonetheless, our outlook has deteriorated with most economic forecasts for the year, having been downgraded slightly, and the shape of the recovery has changed to reflect a more gradual upturn than had previously been proposed.

What are Gartner Dataquest's predictions for the new year? This article will provide you with the answer. For more detailed forecast information, please also refer to "Semiconductor Packaging and Assembly 2002 Review and Outlook" (SEMC-WW-DA-0066), "Silicon Wafer Market Outlook: Modest Growth Expected in 2003" (SEMC-WW-DA-0067) and "Positive Outlook for Wafer Fab Equipment Market in 2003" (SEMC-WW-DA-0068). See also "Semiconductor Manufacturing: Positive Growth in 2003" (SEMC-WW-TB-0002) and "Semiconductor Capital Equipment Forecast Data, 1Q03" (SCEM-WW-MS-0142).

Predictions

Electronics Manufacturing Services

2003 Prediction

The electronics manufacturing service (EMS) industry will see a mild upturn in 2003 in line with a recovery for electronic equipment. The original equipment manufacturer (OEM) outsourcing trend continues to be strong; however, negotiations between the EMS and OEM sectors will become increasingly complex. Strong competition from Asian original design manufacturers (ODMs) will keep EMS profit margins weak.

Impact on 2003

Consumers will continue to benefit from lower hardware prices on mature products. Prices on newer designs are likely to fall quickly as the product life cycle is shortened with stronger OEM-EMS relationships accelerating the introduction of new products by OEMs.

Reacting in 2003

To prepare for market changes, EMS suppliers should diversify sources of revenue:

- Offer additional services, such as complete design solutions, semiconductor contract manufacturer (SCM) and aftermarket services.
- Penetrate market segments other than traditional data processing and communications.
- Take advantage of new opportunities in the medical and industrial electronics segments.

**Foundry**

**2003 Prediction**
We forecast foundry sales revenue to gradually re-accelerate for an annual expansion of 23 percent in 2003. We expect first-quarter sales (sequential) to be down by 5 percent. The second quarter will experience a very gradual pickup before a substantial demand recovery reappears in the third quarter and continues the rest of the year. Some consolidation is inevitable as the downturn stretches into its third year. Those with a defensible niche in process technology or design expertise and those with a low-cost structure (that is, fully depreciated fab) are the most likely survivors.

**Impact on 2003**
As sales gradually accelerate, manufacturing utilization will increase. Wafer price movements will follow. Beware of leading-edge supply tightness, especially if demand outpaces current projections.

**Reacting in 2003**

**Foundry Users**
Users should choose their foundry partners carefully, as always. If possible, qualify a second foundry source for critical production needs, especially if your primary foundry is vulnerable. Capacity is now in ample supply, but leading-edge capacity (0.13 micron and below) could tighten if demand growth resumes in the second or third quarter of 2003, so a long-term strategy for ensuring supply continuity is crucial.

**Foundry Vendors**
Sustainable access to capital is critical, yet many foundry vendors will be unable to achieve this in the current climate. Vendors should develop technological alliances and strategic collaborations. Agreements must lead not only to improved manufacturing processes, but also to co-development of standard technology platforms to the benefit of all parties.

**Semiconductor Assembly and Test Services**

**2003 Prediction**
Excess capacity in mature packages will likely remain for the duration of 2003. However, we expect some tightening in the capacity available for newer, advanced packages as the shift to array package technologies continues.
Impact on 2003
Overcapacity in most of the mature packages will continue. Too many semiconductor assembly and test services (SATS) companies are competing for business, which has resulted in severe price erosion. A consolidation wave will occur as the recovery continues to gain momentum. Companies that have targeted niche markets (such as discrete or power packages) will continue to do better as business conditions improve. Package designs using advanced, fine-pitch wire bonding will increase in demand.

Reacting in 2003
Users should choose their SATS partners for the long term. Capacity is in ample supply, but leading-edge packages (chip scale package [CSP], quad flat no leads [QFN] and flip chip) could tighten if demand growth resumes in the first half of 2003, so a long-term strategy for ensuring supply continuity is crucial.

Wafer Fab Equipment Technology 2003 Prediction
Reliability and integration issues for 130-nanometer (nm) and 90-nm technology will be resolved, leading to an increase in 130-nm and sub-130-nm designs. Technology purchases will continue to dominate; 300-millimeter (mm) systems will be the primary toolset being purchased until the latter half of 2003, when capacity buys will begin to fill the existing 200-mm shells and the partially filled 300-mm facilities.

Impact on 2003
The impact of the 130- to 90-nm transition is broad. Some of the major impacts will relate to the following:

- Integration yield and reliability problems are not unusual when ramping a new technology node, especially one that has as many material and design changes as 130 nm. In early 2003, an intense focus will be on yield and reliability issues while these technologies are ramping.
- Companies should expect 300-mm sales to ramp as the existing 300-mm facilities add capacity as a result of device demand increases for leading-edge technology.
- 193-nm stepper technology will begin to emerge strongly in the second half of 2003 as 90 nm moves past pilot lines into full production.

Reacting in 2003
Wafer fab equipment (WFE) manufacturers will need to be prepared to react quickly when the demand faucet is turned on again. Quick reaction will be needed in key areas:

- Companies should be prepared for a quick ramp in masks as well as equipment once the 130-nm reliability issues are understood.
Equipment companies will need to have a dual focus on 200 mm as well as 300 mm. The latter is anticipated to break the 50 percent mark (as part of total spending) in 2003.

Customer supplier alliances will need to become tighter to ensure a better understanding of the customer’s needs and the timely delivery of tools if the market ramps faster than expected.

While equipment lead times are short today, equipment vendors have eliminated manufacturing capacity in an effort to remain profitable or to gain profitability. Beware that the supply chain might not be capable of taking the load of rapid demand growth; plan carefully, especially for purchases of mission-critical equipment, because lead times could rapidly jump.

**Wafer Fab Capacity/Utilization 2003 Prediction**

Overall fab utilization will climb gradually to almost 90 percent through 2003.

**Impact on 2003**

Leading-edge utilization will remain in the high 80 percent to low 90 percent range throughout 2003. Semiconductor manufacturers will manage fab capacity carefully through 2003, adding incrementally only in response to increasing demand. In addition, yield improvements in 130-nm fabs will effectively add new capacity with minimal capital investment. Overall, expect slow but positive growth in capital spending for the year.

**Reacting in 2003**

**Chip Vendors**

Remain cautious with spending to minimize the release of additional capacity into the market. Sit tight and spend smart. Caution: Do not neglect technology capability or impact the productivity of fabs. Prepare cautiously for an upswing, bearing in mind that some equipment, especially 193-nm steppers, still has long lead times.

**Equipment Suppliers**

Identify all incremental opportunities and develop relationships with chip vendors in anticipation of higher growth in 2004 and 2005. In 2003, 90-nm equipment selections will occur and provide opportunity for the future.

**China Semiconductor Manufacturing Industry 2003 Prediction**

Beware of the hype because fewer than five semiconductor manufacturing plants in China will start production in 2003.
Impact on 2003
The semiconductor production industry in China has been quite exciting over the past two years. However, of the 10 to 20 new announcements in 2000 and 2001, only one fab has started production. We believe as China’s electronics industry continues to boom, more new fab announcements can be expected in 2003. Nevertheless, it will be difficult to generate funds for fab expenditure in today’s economic environment, no matter where the fab is being built. Therefore, many new fab constructions in China will be slowed, similar to the situation in the rest of the world.

Furthermore, because the local Chinese market demands more-mature technologies, the majority of the fab technologies will be transferred from foreign semiconductor vendors. Because the global semiconductor market will continue to be soft in the first half of 2003, we do not expect foreign (non-Chinese) technology transfer will accelerate during that time. Nevertheless, second-hand equipment transfer will be popular. As foreign manufacturers move toward 12-inch-wafer equipment or close underutilized fabs, manufacturers in China can take advantage of the low-cost depreciated 8-inch equipment. By acquiring the less-advanced equipment, Chinese manufacturers can also bypass the technology embargo imposed by the United States.

Reacting in 2003
Semiconductor Vendors
Beware of the hype surrounding the market in China. Although the Chinese government plans to expand its semiconductor manufacturing industry and expects to build 25 fabs by the end of 2005, the growth of the Chinese production sector will depend on the global economy and the global demand for semiconductors. The industrial growth in China will depend heavily on its capital generation capability and the financial status of foreign technological partners.

Semiconductor vendors should note that they do not need to have production facilities in China to serve the Chinese market.

Look carefully for regional or local manufacturing partners if China is going to be a targeted market. Despite our earlier comments, China’s demand for semiconductors will continue to grow faster than the rest of the world. The country has established a relatively complete semiconductor value chain in the past two years. Although the technological levels from integrated circuit (IC) designs to packaging cannot be considered world-class standards right now, we expect China can attain relatively normal standards within the next three years. Although we do not recommend that companies ”jump on the bandwagon” and build a fab in China, they should consider manufacturing their products in this region to support their customers more efficiently.

Note that relationship building will continue to be necessary when doing business in China. Return on investment will not be immediate, but vendors that are early to market tend to build up relationships over a longer period.
Equipment and Materials Vendors
The still largely nonpenetrated Chinese market provides both opportunity and risk. But caution is warranted because we anticipate this market to develop more slowly than most people think today. Be prepared for a more gradual uptick in demand. Use joint-venture and distribution agreements not only to build a beachhead but also to limit risk and capital commitment.

As is true for semiconductor vendors, relationship building will continue to be necessary for equipment and materials vendors when doing business in China. Again, return on investment will not be immediate, but vendors that are early to market tend to build up relationships over a longer period.

Southeast Asia Semiconductor Manufacturing Industry
2003 Prediction
A significant portion of the low-end, high-volume semiconductor manufacturing facilities in Southeast Asia will be lost to China by the end of 2003 as China continues to take investment away from the region.

Impact on 2003
Increasing labor costs in Singapore have caused the country to be less competitive. Its nearest neighbor, Malaysia, has also become less cost-competitive than China in the past couple of years. Political and religious instability in Indonesia and the Philippines and the lack of good infrastructure have also impacted the region’s manufacturing industry. As a result, an increasing number of manufacturing operations have started to move out of Southeast Asia toward the northern part of Asia. The economic downturn of the past two years has accelerated this trend.

China will compete with, but will also invest in, the Southeast Asia region. We have seen this in some of the stronger Chinese manufacturing industries, such as the television production industry. Many Chinese TV manufacturers have already set up plants in India and Indonesia to take advantage of the local markets.

In most of this region, manufacturing will continue to be important to the local economies. Singapore, for example, will continue to encourage companies to move up the technology value chain and develop innovative manufacturing processes, automation systems, software, and design and development on the island. Malaysia is also moving up the value chain. It entered the wafer manufacturing space in 2001, encouraging the establishment of design centers in the Multimedia Super Corridor (MSC), moving up into automating testing processes and research into advanced technologies.
Reacting in 2003
Semiconductor Vendors

Take further advantage of the huge presence of larger global electronics manufacturers in this region, particularly in Singapore and Malaysia. Chip makers can access these global players — such as Hewlett-Packard, Sony, Matsushita, Philips, Siemens and Creative — concentrated in one location.

Note that the Southeast Asia region has built a complete semiconductor supply chain and will move toward focusing on higher-value-added manufacturing. Singapore alone has more than 60 companies, which include more than 30 IC design houses, 15 wafer fabs, and more than 15 assembly and test facilities. In addition, a strong supporting base provides direct support to semiconductor operations, including supply of equipment, materials and technical services. With such a complete base, it is easier for companies to move up the value chain.

Taiwan Semiconductor Manufacturing Industry
2003 Prediction

Taiwan semiconductor production revenue will grow by more than 10 percent in 2003. While Taiwanese manufacturers will lead the global foundry market, only two or three major Taiwanese dynamic random-access memory (DRAM) vendors will survive.

Impact on 2003

We do not expect market demand to improve appreciably before the second half of 2003. Therefore, overall 300-mm fab construction and ramp-up expenditure will dominate capital spending in Taiwan in 2003. We believe the existing 200-mm fab capacity will remain sufficient for demand through 2003. Research and development expenditure for foundry vendors will continue to grow, particularly for 90-nm development and other specific areas, such as complementary metal-oxide semiconductor (CMOS) image sensors, lower-power/high-speed embedded memory, silicon germanium radio frequency bipolar CMOS (SiGe RF BiCMOS), and other system-on-a-chip (SOC) and Internet Protocol (IP) solutions. DRAM vendors will deploy 0.13-micron technology to lower costs during 2003.

The semiconductor manufacturing industry in China will not pose a strong threat to Taiwan in 2003, but Taiwan may lose some market share because of average selling price (ASP) erosion on low-end devices. Smaller manufacturers will start to feel this effect during 2003.

Reacting in 2003

Vendors should find ways to work with the very strong OEM/ODM infrastructure in Taiwan. This has mostly focused on PC products but is poised to expand into other sectors, particularly in communications and consumer applications.
Taiwan semiconductor vendors need to be aware of the unique situation that applies to trade and investment relationships between China and Taiwan. Taxes, government regulations and transportation infrastructures in different districts are still barriers when doing business in China. A "Taiwan made" brand should be promoted to capitalize on Taiwan's good technology image in China.

Taiwan semiconductor manufacturers should focus on advanced technology, such as 0.13 micron and below. Such advanced technologies, together with SOC and IP, will provide the key tools for the vendors to differentiate their market segmentation with competitors in China. We expect that 0.13-micron technology will represent more than 20 percent of the foundry revenue in 2003, whereas it was less than 4 percent in 2001.

**Key Issue**

How will market conditions affect semiconductor manufacturing, procurement and cost models?