Semiconductor Supply Chains: An Urgent Need for Change

Why Hyper-growth in Demand From Consumer Device Companies Means Semiconductor Vendors Need a New Operating Model

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Semiconductor Demand: A Radical Shift Gathers Pace
A few years ago, the global market for semiconductor manufacturers was relatively stable and predictable. The overwhelming majority of demand came from the computer and industrial equipment sectors. As a result, every aspect of semiconductor vendors’ supply chains—from R&D and design, through manufacturing, to sales, fulfillment and post-sales support—was geared to meeting the requirements of these segments.

In terms of semiconductor development and delivery, these customers valued chip functionality above speed-to-market. With an end-user refresh and upgrade cycle of three to four years for most computers and industrial equipment, a semiconductor production cycle of 6 to 12 months was not a constraint on their own new product introduction (NPI) cycles.

Fast forward to today, and the shape and dynamic of the semiconductor market have changed dramatically, driven by headlong growth in demand for semiconductor from manufacturers of “smart connected devices” such as smartphones, tablets and PCs. And this growth is set to continue.

IDC’s March 2012 forecasts for the global hardware market found that shipments of these devices will rise from nearly 1.1 billion in 2012 to just under 2 billion in 2016 (see Figure 1).

This trend has major implications for the semiconductor supply industry. As Figure 2 shows, industrial products accounted for about 16% of global semiconductor market revenues in 2012, and are expected to stay at around that level consistently from 2012-2015, growing at a CAGR of 7.5%. But this growth is expected to be outpaced significantly by revenues from consumer-focused smartphones, tablets and PC providers, which are estimated to grow at 11% CAGR. As a result, in 2015 these customers are expected to account for 62% of the market by revenue and 22% by device units.
Rising Value and Volumes

The contrasting growth paths between the different segments reflect rocketing consumer demand for smart devices. Beyond the shifts in the relative market value of the segments, the volumes of consumer device units produced in the future will surpass the industrial segment—further intensifying the challenges for semiconductor providers, as they strive to respond to the changes in their customer base.

Furthermore, the rate of growth will also vary between different “smart equipment” segments. As Figure 3 shows, semiconductor demand from smartphone makers is predicted to grow by 23% compounded annually in 2010-2015. But demand from tablet manufacturers—while still smaller in absolute terms—is expected to surge to a CAGR of 59%.

These trends mean that semiconductor makers are facing a scenario where the market as a whole is flat or growing only gradually, yet certain segments are experiencing “hyper-growth” in both revenues and unit volumes. The overall semiconductor market is predicted to grow at a CAGR of only 4.6% from 2010 to 2015—but at least 63% of that growth is expected to come from smartphones and tablets. To build higher value in such an environment, companies will need to focus on where the incremental growth in revenues is coming from.

For semiconductor vendors, tapping into the hyper-growth in the consumer device segments is made more challenging by the ongoing acceleration in the NPI lifecycle of these products. The time-frames for launching new products vary between different device manufacturers. But the general trend is to release a new device at least once a year, and often much more frequently than this (see information panel).

This short development cycle has contributed to a rapid proliferation in products: the first tablets were launched in 2010, yet by the end of 2011 there were already 102 different tablets on the market or in production, from 64 vendors. The number of smartphones is expanding at a comparable rate—with the result that by 2015, over 300 tablets and more than 1,000 smartphones are expected to be released.

Each of these devices will seek to differentiate itself through its own specific feature functions—which in turn will be driven by the capabilities of the semiconductors embedded in the device. Yet the products offering these differentiated functions need to be brought to market ever more quickly, in a fast-moving marketplace where having the latest gizmo is a key part of the appeal for consumers, making speed to launch a critical success factor.
Accelerating Product Cycles: Various Approaches

Apple’s approach—evident with the iPhone and iPad—is to launch only one enhanced model of each of its products every year. Other manufacturers have much faster product cycles: for example, Nokia launched 40 variant models in 2011 and more than 20 Smartphones in 2012. And Samsung launched 10 different tablet models of its Galaxy Tab since 2011.

(Source: Apple, Nokia and Samsung Websites)

...Are Challenging Existing Semiconductor Business Models

In combination, these dynamics mean that device companies want semiconductors that support an escalating range of functionalities—ever higher-resolution screens and cameras, higher-quality sound and video recording, higher-capacity memory, voice recognition, dual-core processing, and more—at ever shorter cycle speeds, and often fitting into ever smaller form factors. Yet the current manufacturing and supply chain lead times for semiconductor devices tend to be around 24 to 28 weeks.

With many device makers now launching several new or upgraded products a year, the inescapable conclusion is that current semiconductor supply chains are too slow. A six-month development cycle for a new semiconductor risks becoming a serious critical-path constraint on a device whose entire delivery cycle is shorter than that timeframe.

Alongside time pressures, semiconductor makers seeking to capitalize on the hyper-growth in consumer devices also face challenges around cost and complexity. In the days when computer and industrial equipment companies dominated the market, integrated circuits could be priced ahead of anticipated volume. But in the world of consumer devices, future demand is far less predictable, making this approach to pricing more risky. Yet consumer devices also require higher inventory levels in case of an unexpected spurt in demand.

Also, since consumer products tend to have fixed competitive price points—such as US$99—the return on investment can be elusive. Smartphones in particular are characterized by high pricing pressures. These are typically countered by adding extra features, which in turn increases the design costs.
The Key Question for Semiconductor Providers...

All of these factors point to one key question: can chip companies keep pace with their consumer electronics customers?

Or, to put it another way: if consumer end-equipment manufacturers are driving new products into the market at 12 month intervals, is it sustainable that up to 50% of this NPI lead-time will be consumed by the production of a single component?

Currently, semiconductor companies may be in no hurry to tackle this question. As long as semiconductor supply chains are not on the critical path of the NPI cycle for consumer devices, chip firms can avoid the question of lead times, and simply focus on not being the slowest provider in their industry.

...As Consumer Device Product Cycles Continue to Shorten

However, over time, NPI cycles for consumer devices will inevitably fall below the semiconductor lead-time boundary. Once this happens, chip companies that can deliver on materially shorter lead-times will command higher average selling-prices than their potentially technically superior competitors, because early market share capture of consumer devices is exceptionally valuable.

As a result, it’s clear is that semiconductor companies that succeed in significantly accelerating their supply chains and shortening their lead-times will be well-placed to harness a bigger share of demand from consumer device OEMs. As we’ve already highlighted, these are the customers who will represent the semiconductor market’s key growth area—indeed its only area of hyper-growth—over the next few years.

In our view, semiconductor companies can successfully harness this opportunity by re-engineering and realigning their supply chains to suit the needs of the consumer device industry. Those that achieve this change will position themselves as the industry’s high performers. We will now examine how they can do this.
Four Actions to Reshape Semiconductor Supply Chains for a Consumer Device-Led World

To tap into the opportunities offered by consumer devices, semiconductor companies need to drive improvements across various areas of their business. Figure 4 shows a schematic of a typical semiconductor company’s operating model, highlighting the key functions and processes.

In our view, the key to accelerating the value chain to suit the needs of consumer device companies lies in driving change in the four segments of the operating model colored in light blue:

1. Market devices and services
2. Innovate solutions and manage R&D
3. Manufacture devices and develop solutions
4. Fulfill demand.

**Define Business and Operating Strategy**
- Corporate strategy
- Organizational strategy
- Growth and innovation strategy
- IT strategy
- Technical strategy

**Market Devices and Services**
- Market intelligence
- Incorporating customer input
- Creating device architecture
- Marketing strategy & planning
- Marketing execution
- Enablement
- Developing and executing pricing strategy

**Innovate Solutions and Manage R&D**
- New product, technology and solution strategy
- Manage R&D, product portfolio, product and component costs
- New product and service development
- Product sustainment, legacy, end of life

**Manufacture Devices and Develop Solutions**
- Supply chain strategy and planning
- Manufacturing sourcing
- Quality product
- Quality
- External manufacturing execution
- Logistics
- Capacity planning
- Investment

**Sell Products and Services**
- Sales strategy
- Direct and indirect sales
- Post-sales support

**Deliver Services and Manage Customer Support**
- Service strategy
- Customer care
- Warranty
- Service parts
- System installations
- Learning services
- Monitor installed base
- Field technicians
- Service

**Manage Indirect Channel Ecosystem**
- Partner strategy and offerings
- Indirect channel operations
- External manufacturing relations
- Partnership and alliances
- Distribution
- System integrator relations
- Reporting and measurement

**Manage Enterprise**
- Finance & Accounting
- Asset management
- Product programs
- Business performance
- Quality and reliability
- Environment and safety issues
- Information technology
- Human capital
- Intellectual property
- Regulatory
- Legal
- Procurement

*FIGURE 4: Schematic of a semiconductor company’s operating model based on Accenture Analysis conducted between 2011-2012*
In a consumer device market where speed to launch is critical, and where device differentiation is based on feature functionality driven by semiconductor capabilities, the relatively late involvement in the OEM’s development process is no longer acceptable. Experience shows that when chip vendors are not involved until the product definition stage, this results in four negative outcomes:

- Reduced time available in the design cycle for semiconductor vendors
- A less rigorous screening mechanism at the concept phase
- Adoption of standard designs in preference to IC innovations
- A need for redesign, and ultimately higher costs.

To avoid these risks, chip developers need to become more integrated into their OEM customers’ NPI cycle, including getting involved in their product development during the concept phase.

2. Innovate Solutions and Manage R&D

Integrate the dynamic of functional and vertical integration, and invest in “killer apps”

These changes involve a focus on four priorities within this segment of the operating model.

**Functional integration**
This entails the integration of analog, mixed-signal and digital components in advanced nodes, resulting in more features, better performance, reduced costs, lower power use, and faster time to market. To realize all these benefits, semiconductor vendors need to have a constant dialogue with their customers (both EEMs and OEMs) using process integration road maps.

**Vertical integration**
Software is becoming increasingly critical to semiconductor performance, and the design and style elements of end-equipment are now commanding a higher premium than the chips inside. Therefore it is critical to integrate software and system design capabilities alongside chip design and development, for example through partnerships or acquisitions.

**Embedded software**
While the underlying chip still offers differentiation in terms of power consumption or specific functions, the ability to change the software the final functionality layer on the fly is becoming critical. For semiconductor companies, the ability to stretch designs across wider sets of usage scenarios to achieve faster time to market will be key to competing effectively in the market.

**3D IC technology**
This involves the integration of two or more layers of active electronic components, both vertically and horizontally, into a single circuit. The usage of 3D system ICs is rising, driven by the benefits they offer around performance, power, time-to-market and cost.
3. Manufacture Devices and Develop Solutions

Resolve supply-side constraints to improve product development and lead times

The actions needed in this segment focus around supply chain considerations, extending the enterprise via partnerships, and enhancing skills and capabilities.

Supply chain considerations include:

Capacity planning
Semiconductor companies need to be able to cater to large die-size application processors, for which demand will rise as design commonality between tablets and smartphones increases. 300mm capacity has increased by 28% in 2012 alone, and is expected to continue to grow over the medium term.

Supply chain visibility
Chip vendors need to provide OEM customers with greater visibility into semiconductor supply chains, to enable closer collaboration and better planning of product launches.

Segment mix
Supply chains need to be optimized to cater to new demand trends. For example, in 2012 NAND replaced DRAM as the largest memory segment.

Extended enterprise via partnerships
To meet increased demand and access new capabilities, semiconductor companies will develop multiple partnerships with a variety of organizations. These partnerships will harness collaboration to enhance businesses’ agility, improve asset utilization, and respond to ongoing rapid changes in technology.

Skills/capability enhancement
To compete more effectively in future, chip vendors will need to continuously develop new capabilities, whether this involves the short-term adoption of functional integration to create multilayer, multifunctional technologies, or a long-term capacity plan to adopt 450mm manufacturing.

4. Fulfill Demand

Enhance production capacity to fulfill customer demand

In the demand fulfillment area, companies need to improve their capacity scalability and inventory management, and upgrade their logistics and distribution capabilities.

Capacity and inventory actions will include:

Inventory planning
Classic inventory planning techniques and levels will not work when there is a need to manage the sudden spurts in demand that can occur with consumer devices. Chip vendors need to determine the optimal inventory levels, taking into account short product lifecycles and high demand. Chip vendors will need to strike a fine balance between having excessive inventory and creating bottlenecks.

Capacity enhancement
Semiconductor companies will have to expand their capacity in order to cope with the distinct characteristics of the NPI cycles for consumer device OEMs— which include reduced lead times and potentially exponential sales growth.

Optimal inventory and safety stock
Levels will need to be adjusted continuously to keep pace with the rapid phase-outs of existing models.

Logistics and distribution
Planning for large volumes at high pace
Given the high volumes and increased frequency of orders, fulfillment timelines must become shorter—meaning fast and efficient inbound and outbound logistics will play an increasingly important role.
Conclusion

As consumer take-up of smart connected devices continues to rise, and as device vendors launch a proliferating array of devices differentiated on speed-to-market and feature functionality, semiconductor vendors face a fundamental challenge. Put simply, they need to avoid being part of the problem—and reposition themselves as a vital element of the solution.

Transforming for High Performance

This is a challenge because of their legacy value chains. Built up during the era when demand for semiconductors was dominated by computer and industrial equipment OEMs, chip companies’ existing operating models are not equipped to support the rapid pace of new product introduction cycles for consumer devices. As a result, IC vendors are incapable of meeting the needs of the “hyper-growth” segments of their customer base, where the majority of the industry’s incremental value and revenues will be generated.

In the short term, chip providers may be able to struggle on with their existing product development cycles of up to 28 weeks. But the crunch will come once the consumer device OEMs’ NPI cycle time dips below that of their semiconductor suppliers. This game-changing watershed will trigger a fundamental shift in semiconductor supply chains, reducing the value of manufacturing/material utilization—and enhancing the value generated from speed-to-market.

When these new market dynamics emerge, semiconductor vendors that have already implemented the four set of operating model actions we have described in this paper will be well-placed to lead industry revenue growth and achieve sustained high performance. And as chip vendors prepare for this future market environment, there is no time to lose. As semiconductor market value continues to migrate toward smart consumer device OEMs, the steps that providers take now will shape the success of their businesses for many years to come.
To learn more about how Accenture can help your semiconductor business transform its operating model and supply chain for high performance, please contact:

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