



J.Gold Associates LLC, 6 Valentine Road, Northborough, MA 01532, USA
www.jgoldassociates.com +1-508-393-5294

Could Looming Chip Supply Issues Derail The Mobile Market?

Over the past several years, the semiconductor market has changed from a primarily vertically integrated model (e.g., ownership of design through manufacturing) to one of chip design efforts separated from production (the foundry model). This has allowed many new entrants into the market that no longer needed to raise incredible sums to build and operate their own fabs. But can process technology and production keep pace with the needs of the mobile market or is trouble on the horizon?

With state of the art fabs now costing \$5B-\$10B each, the “fabless” model has provided an advantage to many smallish firms with great ideas for chips, but no means to build advanced production facilities. It also created mega-fab companies (e.g., TSMC, Samsung, Global Foundries) that were able to invest in facilities and sell their production capacity to all comers. This fundamental shift of the supply chain created the vibrant and highly competitive chip market we see today. For example, the ARM-based mobile ecosystem could not exist without this commodity fab model with Qualcomm, Nvidia and even Apple using this path. And even the veteran AMD, who long maintained its own production facilities, has divested its manufacturing to concentrate all of its resources on competitive designs (primarily aimed at Intel).

However, the foundry model has recently shown strains that could derail, or at the very least restrict the growth of the mobile market. Commodity fabs no longer can be counted on to always produce chips in the quantity and/or quality required. Want proof? During its last quarterly update, Qualcomm announced sales were negatively impacted by lack of enough chips coming off the production line at its major supplier – TSMC. Indeed, TSMC, the largest of the merchant foundries, has had issues getting its fabs to run at 28 nm (its latest step on the ever decreasing size of transistors built inside of increasingly more complex chips). This is affecting not only Qualcomm but potentially Nvidia and other fabless chip companies as well.

Most new chip companies started in the past several years have embraced being fabless, assuming they could always get chips produced at high volume foundries, and avoid the huge expense of building out a fab that they couldn't fully utilize. But with demand soaring for chips in the mobile market, is the supply chain capable of fulfilling the needs of these fabless chip suppliers? Can it fulfill the promise of Moore's Law, especially given the increasing degree of difficulty involved with reducing process geometries every 2 years and newly created transistor structures (e.g., finFET 3D, metal gate)? Can the suppliers continue to invest in new advanced

technology fabs to the tune of tens of billions of dollars every few years? And will competing demands from the highest volume purchasers preempt orders for important but lower volume devices from smaller players?

In addition to the above, there exists another problem with the commodity fab market. A little known family secret is that counterfeit chips can easily come out of these foundries, hurting the IP owner and flooding the market with inferior products (some estimates are that as much as 20% of chips going into the mobile market are counterfeit). Fabs build chips to spec from the designs they are handed. They generally have no knowledge of whether the chips are blatant “rip-offs” or even badly designed. Who is going to police this situation?

While companies like Intel and Samsung have been disparaged for spending vast sums on new leading edge foundries when there was a glut of capacity, it now appears that their investments were not only well warranted to keep control of the supply chain for product, but also warranted as a way to keep 2-3 years ahead of the competition in process technology (in both transistor size and structure). AMD is feeling the pressure of having sold off its fab to Global Foundries who has not been able to deliver all the chips required, forcing AMD to seek to break its long term exclusive contract. Even Apple has been rumored to be having difficulty finding a another vendor for its chips to give it a second source beyond Samsung and provide some volume insurance, as well as price negotiations leverage. And the ability of Intel to “tweak” its chip designs to take maximum advantage of its in-house production has made its chips more competitive in a market where performance/price really matters.

It's likely this effect will only get worse. Those few companies that are vertically integrated will excel at staying ahead of the competition in design, delivery and in some cases even cost of product. Further, as the cost of state of the art fabs continues to escalate with each generation, it will be harder to find capacity in leading edge fabs, particularly in an economy where investment by foundry-only companies will be hard to justify. And even if companies choose to invest in a new fab, it can take 2-3 years before it comes on line and even longer to ramp up to volume.

Process improvements go hand in hand with chip improvements, and those fabless companies who only control the design process can only take advantage of process technology once it becomes available on the commodity market. It can take 2-4- years after new developments are discovered for the technology to “trickle down”. This widening process technology gap gives the vertically integrated companies with significant R&D expenditure a major advantage (e.g., Intel). This is already playing out in the market, as Intel has 22nm and tri-Gate transistors in production well before the rest of the market (by 2+ years).

Bottom Line: Companies that own their own fabs (e.g., Intel, Samsung) have a real advantage in design and performance going forward, and they will be able to accelerate their launch of new, leading edge products. Contrast this with their competitors who are at the mercy of a commodity market not always equal to the task of producing leading edge chips. And companies with their own fabs have a further advantage of being able to take in work from fabless design companies when their own fabs aren't full, often at a premium price. It gives them a chance to maintain a payback on their huge investment, while also offering the market something it needs – state of the art foundry capacity that's in short supply. In the push to leading power/performance chips, competitive advantage will go to the vertically integrated chip companies in the long term. And shortages of popular leading-edge chips may very well continue to hold back the rest.

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