GaAs Industry Overview and Forecast: 2010 – 2015

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Abstract

The GaAs device industry experienced strong growth in 2010. The paper will focus on 2010 market performance and the factors that drove this growth, along with our estimate of the leading manufacturing companies. It will also discuss insights into trends and forecasts for the GaAs industry through 2015.

INTRODUCTION

Strategy Analytics estimates the GaAs device market closed 2010 with revenues of almost $5 billion, a growth of nearly 35%. This was the largest yearly growth rate in a decade, only surpassed by the growth just before the “telecom bubble” burst. This paper will provide some insight into the present state of the GaAs industry with snapshots of company and application market shares. We will also discuss our 5-year market forecast and some of the drivers and threats shaping that forecast.

HISTORY

Figure 1 shows the historical performance of the GaAs device industry from 1999 to 2010. The 35% growth we experienced in 2010 pushed the overall GaAs device market to record revenue levels and only 1999 to 2000 showed a higher growth rate. However, the revenue level of ’99 - ’00 proved to be unsustainable. As the “telecom bubble” burst, the GaAs market declined sharply, only reaching equilibrium in the middle part of the decade. Excess inventory, both in terms of material and capability marked this period as consumers did not embrace the “build it and they will come” philosophy of more capable (and expensive) devices and networks.

As the chart shows, the GaAs market grew steadily from 2005, driven primarily by the dawn of the wireless era. The global economic crisis of late 2008 and early 2009 brought a halt to this growth, but set the stage for the rapid GaAs revenue increase in 2010. With a global economy that still appears unsettled, are we destined to repeat the growth profile of the early part of the 2000s? As we will see, it seems increasingly apparent that current trends are far different from the ones that drove the decline of the GaAs market in the first half of the decade.

TRENDS AND THE FUTURE

The inescapable conclusion is consumers are in love with data-intensive services and applications. Figure 2 shows the most recent Cisco Virtual Networking Index [1] of global IP data consumption.

\begin{figure}[h]
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\includegraphics[width=\textwidth]{figure1.png}
\caption{GaAs Industry Revenue from 1999-2010}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure2.png}
\caption{Cisco VNI IP Data Estimate}
\end{figure}
The study predicts that total data consumption will increase by a factor of nearly 5.5 from 2009 – 2015. Mobile data, driven by the rapid proliferation of mobile apps and smartphones is the fastest growing segment, with a compound average annual growth rate (CAAGR) of slightly more than 100%. This means mobile data consumption is roughly doubling every year! Even with this explosive growth, the amount of mobile data consumed in 2015 will only represent slightly more than 7% of the total amount of data consumed.

The methods and devices used by equipment manufacturers and operators to address data demand is the driving force behind the growth in the GaAs device market. Increasing the data rate and capacity of a network involves a combination of increased channel bandwidth and spectral efficiency. Regulators are freeing up spectrum where they can, but it remains a limited resource. Operators are acquiring spectrum as it becomes available and augmenting this with more sophisticated networks and devices to make better use of the spectrum.

The result is a bit of a patchwork frequency plan of new and existing spectrum. It means a new generation of mobile handsets must incorporate multi-band and multi-standard capabilities. Increasingly, these phones will also integrate Bluetooth, GPS and Wi-Fi capability to increase the functionality of the handset. This added sophistication is increasing the GaAs content in mobile handsets significantly and driving the overall GaAs device market. Figure 3 shows our estimate of the yearly growth rate of mobile handsets and the rapidly increasing penetration of smartphones.

Smartphones, with their voice, video and data capability have finally answered the question, “what’s the killer app?”, that remained unanswered in the mid-2000s. The rapid increase in the use of smartphones is a relatively recent phenomenon that is driving the explosion of mobile data consumption. It has also spawned an entire symbiotic ecosystem of application developers where new smartphone apps lead to more data consumption and increased penetration of smartphones, which increases the desire to create new apps. Figure 4 shows the extraordinary growth of smartphones in 2010 and 2011, with each year having growth rates slightly in excess of 68%.

The sharp ramp in volume from 2009 to 2010 helps explain why GaAs device revenue grew so strongly and reached record levels in 2010. Growth at these high levels is very difficult to sustain and the chart in Figure 4 shows the growth rate dropping off to approach the levels of the overall handset market over time. While the growth engine does not stop, it gets less powerful and this is a trend to monitor.

In addition to the dramatic growth in smartphone quantity, the complexity of the front-end circuitry is increasing to accommodate additional bands and capabilities. Figure 5 shows a representative block diagram of a W-CDMA handset front-end and indicates the potential GaAs opportunity.
Bluetooth, GPS or Wi-Fi functionality. This indicates the enormous potential for additional GaAs device content.

One of the major trends in handsets is to develop multi-mode, multi-band amplifiers that integrate capabilities of multiple single band, single mode devices. This design effort will likely reduce the number of power amplifiers, but the resulting devices will be more sophisticated and perhaps a bit larger. This architecture will rely on switched filter networks to select the appropriate band from the wideband amplifier’s output. This will result in an increasing number of switches with fewer throws than the centralized antenna switches currently use.

With the combination of high volume, more capability and increasing GaAs content in next generation devices, it becomes easy to see why the handset segment is so important to the overall GaAs device market. Figure 6 shows the Strategy Analytics forecast for total GaAs MMIC revenue out to 2015. The wireless communications segment accounts for about 75% of the total revenue and we estimate GaAs devices used in handsets account for approximately 70% of the wireless communications revenue.

To keep pace with the data demands, wireless network operators are developing new network architectures that reduce cell sizes and transmit powers. The industry is coining the terms “small cells” and “hetnets” to describe a new wireless base station architecture that employs many lower power cells around a conventional high power macrocell. Most of the major equipment OEMs have announced products that include remote radio heads, self-organizing, low power cells and cloud-based baseband processing as a means of optimizing the user’s data experience. Figure 7 shows Strategy Analytics’ latest forecast of wireless base station sector shipments.

Developments in handsets drive the entire GaAs device market, but other segments of the market benefit from the increase in data consumption. Increasingly, data that starts or ends with a handset travels on several other wireless and wired networks. We have all seen user-generated mobile video of events that is transmitted wirelessly to a base station, then uses wireless backhaul to the fiber-based transport network and ultimately moves to a fiber or hybrid fiber coax (HFC) CATV network for viewing. As we mentioned earlier, only 7% of IP data is mobile, the remaining 93% resides in a transport network. The same need for higher spectral efficiency and larger bandwidths also drives the networks as they become increasingly intertwined.

The most noticeable trend in this forecast is the growth of what we have called micro and picocells. Transmit power in these cells will range from approximately 250mW to 10W. The implications for the power portion of this market are significant. Under the conventional wireless base station architecture that uses mostly high power macrocells that transmit between 40 and 80W of average power per sector, LDMOS is the dominant technology. As the transmit power levels decrease, GaAs devices become attractive alternatives.
Figure 8 shows our estimate of power device revenue for base station applications. With the number of high power base station sectors decreasing, we anticipate both the market share and revenue derived from LDMOS power devices will decrease. With the quantity of lower power cells set to increase dramatically, this will fuel an increase in GaAs devices used in base station power applications. While the revenue is not on par with handset opportunities, this development in the market will bear watching.

**MARKET SHARE LEADERS**

With the dependence on mobile handsets, it is no surprise that the market leaders in GaAs revenue are the companies most closely associated with GaAs handset products. Figure 9 shows our estimate of the 2010 market share of revenue for GaAs devices. This pie chart includes revenue from merchant GaAs device manufacturers, as well as pure-play foundries. Including the foundry revenue increases total 2010 GaAs device market revenue to nearly $5.45 billion.

![Figure 9. 2010 GaAs Device Manufacturer Market Share](image)

Skyworks, RFMD, TriQuint and Avago Technologies have consistently occupied the top rankings. Together, they accounted for nearly 60% of the entire market. All these companies have a significant presence in the handset market. Initial results from 2011 indicate Skyworks is extending its lead and stronger revenue performance in the second half of 2011 will keep RFMD ahead of TriQuint.

On the foundry side, WIN Semiconductors has firmly established itself as the largest GaAs merchant foundry in the world. After finishing 2009 in a virtual dead-heat with TriQuint’s merchant foundry services, WIN benefitted from an aggressive expansion plan and the trend toward more outsourced foundry activity. We estimate they accounted for nearly 46% of all merchant foundry revenue in 2010.

**COMPETITIVE THREATS TO GAAS**

While the GaAs device market is large and finds application in a wide range of market segments with a variety of performance, frequency range and cost advantages, there is competition. In many of the high-volume markets, GaAs device manufacturers are developing or acquiring silicon-based technologies like BiCMOS, SiGe and SoI. These technologies generally promise significant on-chip integration and lower costs. In the very near future, we forecast SiGe devices will capture share from GaAs in Wi-Fi and automotive applications and SoI will become the dominant technology for handset switches.

**CONCLUSION**

The GaAs industry had a banner year in 2010, the result of a sharper than expected recovery from the global economic crisis of 2008/2009. Fueling this recovery was increasing consumption of mobile data that has driven adoption of sophisticated mobile handsets and smartphones that are rich in GaAs content. These data requirements are also driving development in fiber, coaxial and wireless transport and infrastructure networks, further increasing demand for GaAs devices.

Future growth in the GaAs industry is unlikely to match the levels seen in 2010. While the data consumption trend will continue, ongoing economic uncertainty, slowing growth of smartphone adoption and competitive technologies will reduce GaAs device growth to more historical levels. We estimate the GaAs market will settle into growth rates in the 5-6% range through 2015.

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**REFERENCES**


**ACRONYMS**

- GaAs: Gallium Arsenide
- CATV: Community Access Television
- BiCMOS: BiPolar Complementary Metal Oxide Semiconductor
- GaN: Gallium Nitride
- LDMOS: Laterally Diffused Metal Oxide Semiconductor
- MMIC: Monolithic Microwave Integrated Circuit
- OEM: Original Equipment Manufacturer
- SiGe: Silicon Germanium
- SoI: Silicon-on-Insulator