GaAs Industry Overview and Forecast: 2009 – 2014

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Abstract

Even though global macroeconomic trends are still unsettled, the market for GaAs devices is showing strong growth. This paper focuses on segments leading this resurgence, discussing historical performance, market drivers, leading design and manufacturing companies and forecasts for the GaAs industry through 2014.

INTRODUCTION

GaAs-based devices, whether they are single-function transistors or multi-function MMICs, have become the building blocks for devices used in a broad range of market applications. The performance of these devices is flexible enough to allow use over the proverbial ”DC to light” frequency range and the process is robust enough to accommodate market applications ranging from small quantity customs to high-volume commodity devices. Despite the recent global economic crisis, the GaAs market is showing strong signs of recovery. 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 forecast and some of the drivers and threats shaping that forecast.

HISTORY

Figure 1 shows the historical performance of the GaAs industry from 1999 to 2008. In the beginning of the period, we had very high growth, followed by an equally impressive decline as suppliers responded to the explosion of demand and subsequent burst of the “telecom bubble”. Beginning in 2004, we saw steady growth that allowed the GaAs market to reach levels almost equal to those seen at the height of the telecom demand ramp.

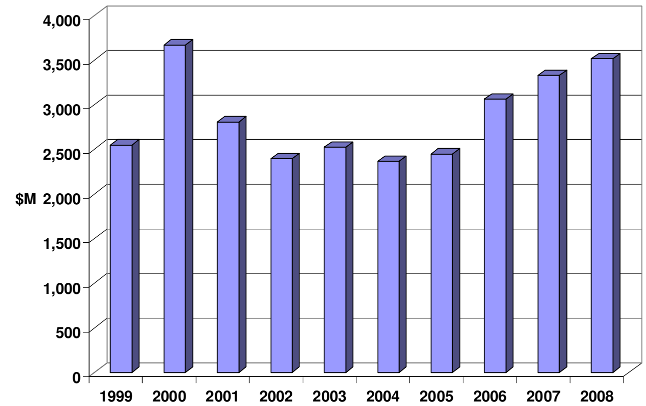

Figure 1. GaAs Industry Revenue from 1999-2008

Unfortunately for all the global markets, 2009 brought the economic meltdown. The GaAs industry weathered the storm, with the market value staying essentially flat. Even though this downturn has been painful to suppliers and OEMs at every link of the value chain, we believe it has not signaled a repeat of the early part of the century for a number of reasons.

In the early 2000’s, handset demand was increasing rapidly and inventory was growing to keep pace. There was also excess bandwidth capability as operators built fiber and wireless networks with the expectation that consumers would embrace these new networks even though there were few compelling applications. When demand failed to materialize as rapidly as predicted, orders and suppliers contracted strongly in efforts to deplete inventory.

In 2009, the environment was significantly different. Handset inventory was much more modest as the industry saw strong growth in “smartphones” that contain substantially more features and complexity than the handsets of the early 2000’s. In addition, driven in large part by the capabilities of these smartphones, consumers have shown a seemingly insatiable demand for bandwidth intensive applications and services.

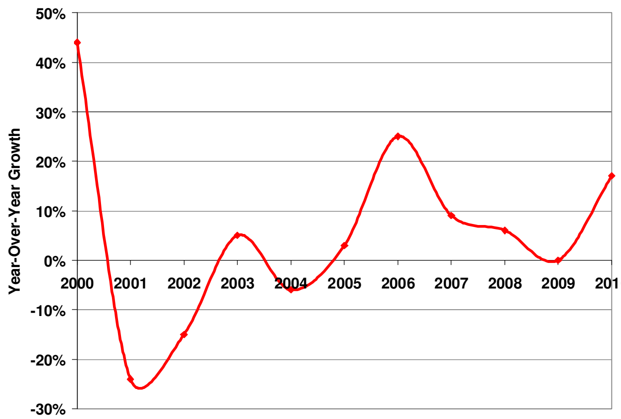

Figure 2. Yearly Growth Rates for the GaAs Market

Figure 2 shows our estimate of the yearly growth rates for the GaAs industry. After a flat growth rate in the market for 2009, we believe user demand for bandwidth will be a key driver across most market segments. We forecast the GaAs market will close 2010 showing a strong recovery with a growth rate of 17%.

DRIVERS FOR THE FUTURE

We have postulated that the demand for bandwidth intensive applications will drive future GaAs industry growth. A large portion of this growth will result from the data generated by handsets, with smartphones increasingly accounting for the majority of this data. Exhibit 3 shows a Strategy Analytics estimate for data generated by handsets. This forecast [1] indicates handsets will generate nearly 5,700 Petabytes (10^{15} bytes) in 2014, a total almost 15 times that of 2009.

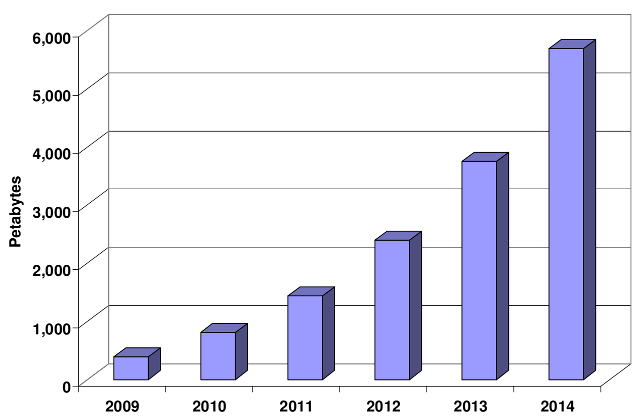

Figure 3. Forecast of Data Generated by Handsets

To address this projected explosion of mobile data demand, operators have been acquiring newly available spectrum and developing higher data rate mobile 3G and 4G air interfaces. The higher data rate standards will launch initially as data only, with voice offloaded to another network. This increases complexity as new bands and interfaces are included in the handset.

GaAs MMICs are still the dominant technology for power amplifiers and switches in mobile handsets. Driven by the size of the market, amplifiers using technologies like CMOS and SiGe are gaining some traction and may provide viable alternatives to GaAs. We estimate GaAs MMIC power amplifiers used in handsets of all types will grow from roughly $1.9 billion in 2009 to slightly more than $2.4 billion in 2014.

This mobile data growth also has implications for several other market segments. The most obvious one is the mobile infrastructure segment that links directly to the number and bandwidth demand of handsets. We expect the growth of the component portion of the infrastructure market to show good growth, increasing from slightly more than $1 billion in 2009 to nearly $2.1 billion in 2014. The majority of this market value resides in the power amplifier and digital processing functions and silicon technology dominates both functions. We believe GaAs is used mostly for the LNA and driver function.

Coupled with the growth in mobile devices is an increasing demand for backhaul capacity. When wireless communication first became popular, many remote cell sites were linked to the switching networks with copper cables. Closer to the large population areas, it was possible the cell site was close to a fiber cable to provide backhaul. As the demand for data is increasing, operators are finding leasing additional T1 lines or connecting to fiber to be prohibitively expensive. Increasingly they are turning to microwave and millimeter wave point-to-point radios to meet their backhaul needs.

Radios used for backhaul operate in a number of different frequency ranges up to 60 GHz. The frequency ranges and performance requirements make these radios ideal for GaAs-based devices. Block diagrams for microwave and millimeter wave radios are rich with amplifiers, mixers, attenuators, frequency multipliers and dividers.

We estimate this market will grow from nearly $86 million in 2009 to reach $105 million in 2014. As new wireless networks are rolling out, the initial market growth will be faster, but will start to decline as network growth slows to where it is no longer offsetting price erosion.

GaAs content in other wireless market applications like VSAT, DBS, automotive radar, Wi-Fi, aerospace & defense and others add to the overall market estimate. There is also a similar explosion of bandwidth demand taking place on wired networks, created in part, by the wireless segments we have described. Foremost among these applications are fiber optic transport networks and CATV/broadband networks.

Activity in these wired networks is becoming more intertwined and linked to wireless networks. The amount of data carried on a fiber optic transport network is rising dramatically as backhaul, faster broadband and video service requirements increase. Optical transport networks that used to run at Mbps are easily into the Gbps range with the backbone networks that aggregate data from metropolitan networks reaching 100 Gbps capability.

The signal in an optical network is modulated light of a specific wavelength, but there are opportunities for GaAs and other non-optical devices. When the optical signal needs to be conditioned, switched, multiplexed, etc., the most common method is to convert the signal back to the electrical domain. This is often accomplished with a photodiode that creates current from the incoming optical signal, a transimpedance amplifier section that converts this current to an RF voltage and any additional attenuation and output amplification necessary to bring the signal to the appropriate level. Once the signal processing is complete, the RF signal goes to a laser driver amplifier that converts the incoming RF signal to a modulated optical output. We believe this market will grow strongly to reach nearly $116 million in 2014.

As consumers embrace faster broadband speeds, high-definition TV, video-on-demand and a host of other new services, operators are scrambling to keep up with this demand. CATV networks, once solely used for television, are now carrying the "triple-play" of voice, video and data signals. To provide the bandwidth necessary to keep pace with this demand, operators are converting to digital transmission, expanding their networks to higher operating frequencies and pushing higher capacity fiber transport deeper into their networks. This is providing strong growth for GaAs components, primarily amplifiers, used in these networks. After a strong initial ramp, driven by a number of factors, we believe the market will flatten out to approximately $144 million.

We believe MMICs make up roughly 94% of the entire GaAs device market. Combining inputs from all the market segments results in the overall GaAs MMIC market estimate shown in Figure 4. The wireless communications category, which is driven by handsets, accounts for roughly 84% of the total market.

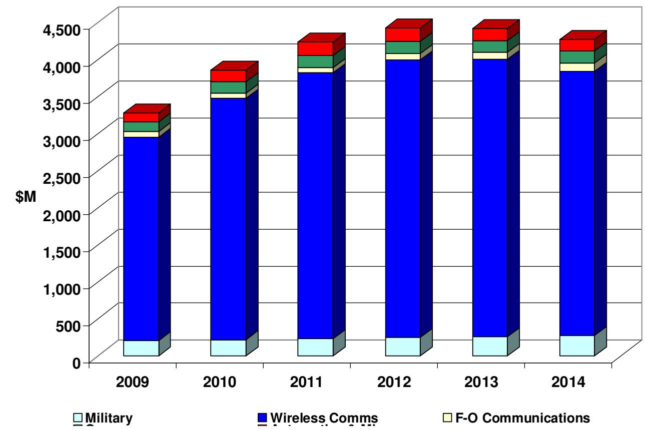

Figure 4. Merchant Segmentation for GaAs MMIC Devices

As Figure 5 shows, we estimate the overall market for GaAs MMIC, discrete and digital ICs will peak at nearly $4.9 billion in 2012 before falling back to slightly more than $4.7 billion in 2014. This represents a 5% CAAGR for the period.

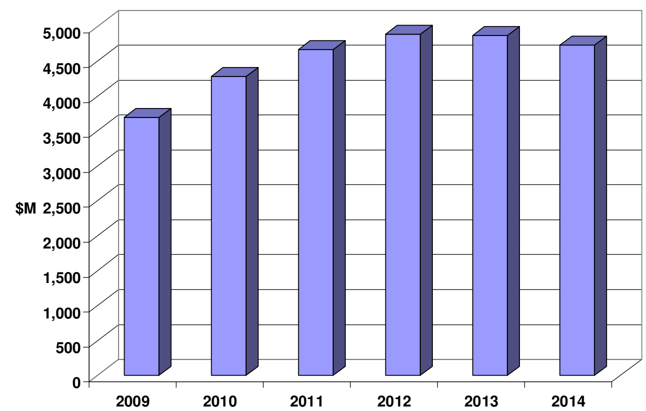

Figure 5. Total GaAs Market Value

MARKET SHARE LEADERS

The discussion to this point has encompassed merchant suppliers who sell devices to OEMs. In addition to this channel, there is demand supplied by captive foundries with sales to internal groups and pure-play foundries that may not know the final application. To get a better understanding of the industry, Figure 6 looks at all GaAs sales activity, whether it is a fabless company like Hittite or a pure-play foundry like WIN Semiconductors. Including the captive and pure-play foundries increases the total 2009 market value from roughly $3.5 billion to $4 billion. A few comments are in order. The top three, Skyworks, RFMD and TriQuint, make up more than 50% of the market and all three have significant participation in the handset market segment. Secondly, WIN Semiconductors has firmly established itself as the largest pure-play foundry for GaAs devices.

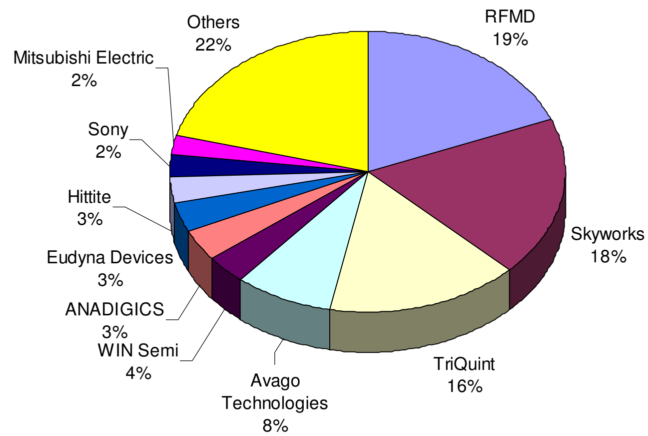

Figure 6. 2009 Market Share for Major GaAs Suppliers

Competitive Threats to GaAs

While the GaAs device market is large and finds application in a wide range of market segments through a variety of performance, frequency range and cost advantages, there is competition. In many of the high-volume markets, technologies like silicon CMOS and SiGe that allow significant on-chip integration are capturing market share formerly held by GaAs devices. In addition to the integration capability, silicon has the advantage of much larger, less expensive wafers. This can dramatically reduce the cost of a silicon die, when compared to GaAs. However, there is a trade-off because the mask set costs of a silicon wafer are substantial, making the cost model most attractive for very high volume markets. GaAs suppliers are fighting the integration advantage by developing processes that allow for different transistor configurations (FET, HBT, HEMT, etc.) on the same wafer.

Another technology growing strongly is gallium nitride (GaN). GaN is a wide bandgap material that can operate with higher power densities over broad bandwidths up to relatively high frequencies and in harsh environments. Initial devices focus on high output power, so these may compete more with silicon LDMOS, but military and commercial applications are seizing on different aspects of the GaN performance advantage. Devices taking advantage of other performance characteristics of GaN will be in direct competition with GaAs devices. Figure 7 shows our estimate of the adoption of GaN and the market segments that will drive this adoption.

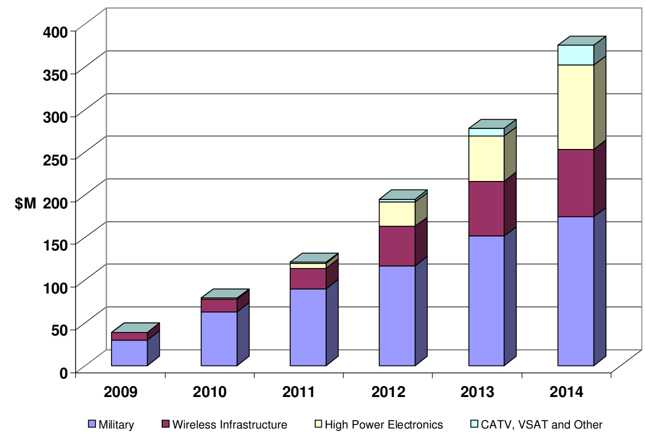

Figure 7. GaN Market Value

We believe GaN, driven initially by military usage, will grow with a 57% CAAGR to reach a market of $376 million in 2014. While there are still hurdles to widespread adoption, the performance advantages of this technology are very compelling and we believe GaN will have a significant contribution in the coming years.

Conclusions

Although the economy has and will continue to unsettle markets, we estimate GaAs devices will show good growth. At the heart of this growth is the demand for services and capabilities requiring higher data rates and more bandwidth. Though competing technologies present growing threats, the combination of performance, frequency, process maturity, total cost and legacy allow GaAs devices to participate in a wide variety of commercial and military market segments.

Acknowledgements

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References

[1] N. Patel, *Global Handset Data Traffic Forecast: 2001 – 2015,* Strategy Analytics Publication, October, 2010.

Acronyms

GaAs: Gallium Arsenide
CAAGR: Compound Average Annual Growth Rate
CATV: Community Access Television
CMOS: Complementary Metal Oxide Semiconductor
DBS: Direct Broadcast Satellite
GaN: Gallium Nitride
HBT: Heterojunction Bipolar Transistor
HEMT: High Electron Mobility Transistor
LDMOS: Laterally Diffused Metal Oxide Semiconductor
MMIC: Monolithic Microwave Integrated Circuit
OEM: Original Equipment Manufacturer
SiGe: Silicon Germanium
VSAT: Very Small Aperture Terminal