

# GaAs Industry Overview and Forecast: 2011 – 2016

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## Abstract

After a strong start in 2011, growth in the entire GaAs supply chain peaked and slowed substantially to end the year. The paper will focus on the 2011 performance of the GaAs substrate and device markets, along with the factors that drove this performance. It will also discuss our insights into trends, drivers and forecasts for the future of the GaAs industry.

## INTRODUCTION

Strategy Analytics estimates the GaAs device market closed 2011 with revenues of slightly more than \$5.2 billion. This growth of roughly 6% extends the GaAs revenue expansion to seven consecutive years. This paper will provide some insight into the present state of the GaAs substrate and device 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 2011. The GaAs device market had an extraordinary year in 2010 with 35% growth pushing revenues easily past \$4 billion for the first time to finish the year at nearly \$5 billion. In the first part of 2011, the entire GaAs industry seemed destined to pick up where it left off in 2010, but then the market faltered.

Looking at the performance shown in Figure 1, the last time the industry saw very large growth was 2000 and then revenue fell sharply, taking eight years to recover. Even though the current growth pattern has similarities with this earlier period, there are substantial differences. The sharp growth in GaAs device revenue in 2010 was followed by a slowdown in the industry. However, the GaAs industry still saw growth, propelling revenue past the \$5B mark to a record level in 2011. There are some troubling trends as the industry saw growth slow substantially in the second half of 2011 and 2012 looks to be a very low growth year. As the paper will discuss, the fundamental drivers for the GaAs industry look strong enough that a repeat of the early 2000's does not seem likely.

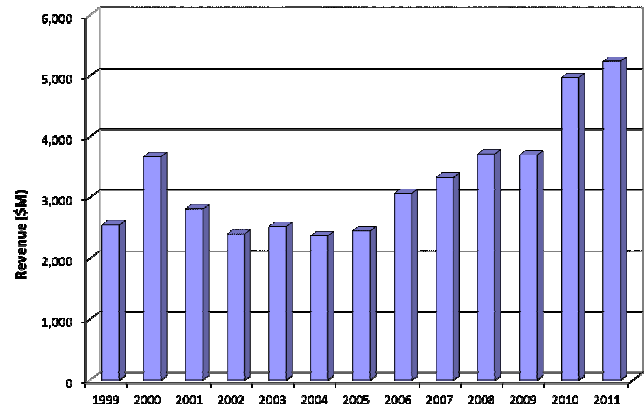


Figure 1. GaAs Industry Revenue from 1999-2011

## THE SUPPLY CHAIN

Not surprisingly, the growth rates and the trends that drive GaAs devices trickle down to influence the GaAs substrate markets. The biggest driver for the entire GaAs device market is content in mobile handsets. One of the strong trends we have seen over the past few years is the conversion of handset switches from GaAs to silicon-on-insulator (SoI) technology. One of the results of this conversion is that the “handset GaAs market” is increasingly becoming the handset GaAs PA market.

Handset switches are very inexpensive, so this conversion has had very little effect on the overall revenue of the GaAs device market. The sheer quantity of these devices however, has had a profound effect on the production and composition of the epitaxial substrates. While it is not universal, pHEMT has historically been the technology of choice for handset switches. Our survey results indicate that about two-thirds of these devices are manufactured on epitaxial wafers processed with MBE deposition techniques.

On the other hand, PAs for mobile handset applications represent a large portion of both the GaAs device market revenue and wafer output. These handset PAs are most likely to use HBT-based devices and our survey results also indicate that about two-thirds of HBT devices are manufactured on MOCVD epitaxial wafers. Figure 2 shows

the total epitaxial wafer production in 2011, as compared to 2010 and the relative share of MBE and MOCVD processing techniques.

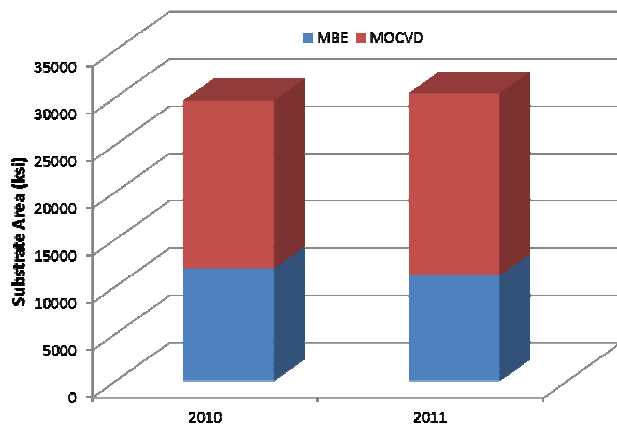


Figure 2. Share of Epitaxial Substrate Production

We estimate the total area of epitaxial wafers produced in 2011 grew by slightly less than 3% to reach 30382 ksi. For the reasons described earlier, there were two very different trends in the market. MBE substrate area fell by about 7%, reflecting the general conversion of handset switches from GaAs to SoI. Offsetting this decline, was a roughly 9% increase in the production of MOCVD processed wafers used primarily for HBT-based handset PAs.

There is reason for optimism for MBE and pHEMT production, as well as the overall epitaxial substrate market. Figure 3 shows our estimate of the future growth of epitaxial production.

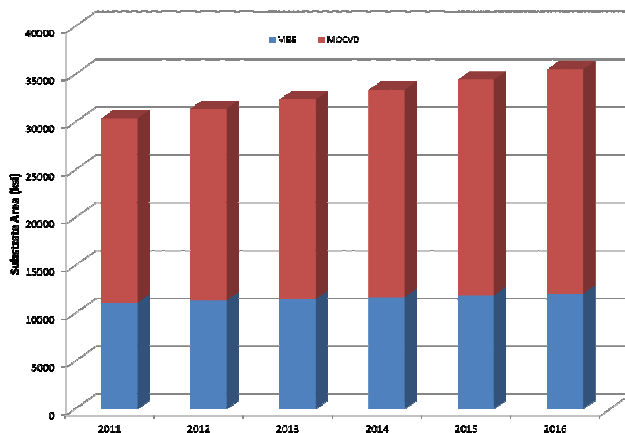


Figure 3. Epitaxial Substrate Forecast

Driven primarily by handset growth and mix, we anticipate the total area of epitaxial wafer production will grow with a CAAGR of slightly more than 3% to reach nearly 35500 ksi in 2016. We believe that most of the

conversion of handset switches to SoI is already complete and the result will be a return to slow growth for MBE material and HEMT-based devices. We believe the existing MBE capacity will be re-tasked to other high-performance applications. Since these applications will not replace the handset volumes that have been lost over the past several years during the conversion, the growth of this segment will lag the overall market. Conversely, the growth of mobile handsets will drive the growth rate for MOCVD processed wafers to rates slightly higher than the overall market.

On the manufacturing side, IQE remains the largest supplier of epitaxial substrate material. We estimate their output grew in 2011, but not quite as fast as the market and this decreased their share fractionally. IQE maintains this top spot, in part, by being the only manufacturer to supply both MBE and MOCVD material.

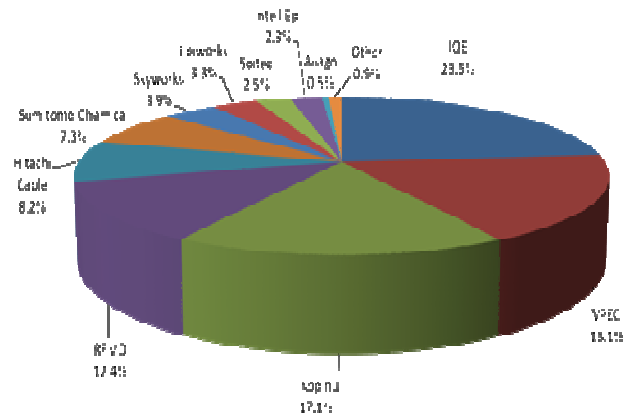


Figure 4. 2011 GaAs Epitaxial Substrate Market Share

IQE looks poised to increase their share and dominance in this market significantly. They have already acquired some of device manufacturer RFMD's MBE processing capability as RFMD has transitioned to SoI for handset switches. This capability will further enhance IQE's hold on the merchant MBE market, where they are the dominant player, accounting for nearly 85% of the total production. Very early in 2013, IQE agreed to acquire Kopin's III-V business activities. Kopin, an MOCVD supplier saw higher than market growth rates in 2011 and VPEC just nosed them out as the second largest epitaxial substrate manufacturer. With the added capability of the second-largest MOCVD manufacturer and RFMD's MBE assets, IQE will become the dominant epitaxial wafer manufacturer.

#### TRENDS AND THE FUTURE

The top-level trend in the GaAs market continues to be the seemingly insatiable consumer demand for data. While the growth rate is slowing, actual data consumption continues to exceed the forecasted values. While all IP data is increasing, mobile data continues to show the strongest

growth, nearly doubling every year from 2009 actuals to the forecast values in 2016. Figure 5 shows a summary of the Cisco Virtual Networking Index [1] of global IP data consumption, including the most recent forecast.

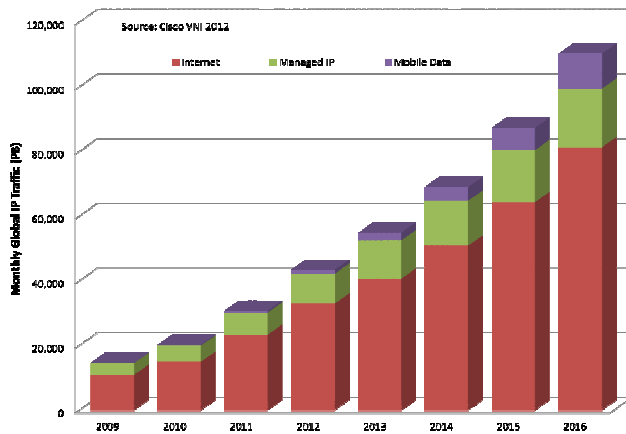


Figure 5. Global IP Data Forecast

The implications of this increasing data consumption bode well for the GaAs device market and supply chain. As the chart shows, while mobile data shows the fastest growth, it is the smallest segment. The largest segment is what Cisco calls “internet” and this includes broadband access and CATV applications. To support the growth in demand and ensure the appropriate quality of service, operators are developing next generation wired and wireless networks, architectures and devices to handle the anticipated increase in data consumption. While it appears uncertainty in the global economic climate is curtailing network-related spending, the demand growth continues. GaAs is an enabling technology for all these networks, so when operators make capital investments in response to the data increase, this will help drive growth in the GaAs supply chain.

The biggest contributor to the rapid increase of mobile data continues to be consumer adoption of smartphones and other multi-band, multi-standard mobile handsets. In addition to handsets, GaAs devices are found in the RF section of most every application, from the technology’s origins in Aerospace & Defense applications, to consumer devices, to wired and wireless networks and even automotive applications. Because of the sheer volume of mobile handsets, they have long been the driver for the entire GaAs device market. The rising number of frequency bands and standards, particularly in smartphones is increasing the GaAs content. We estimate the handset portion of the overall GaAs device market exceeded 55% in 2011 and our segmentation of the market is shown in Figure 6.

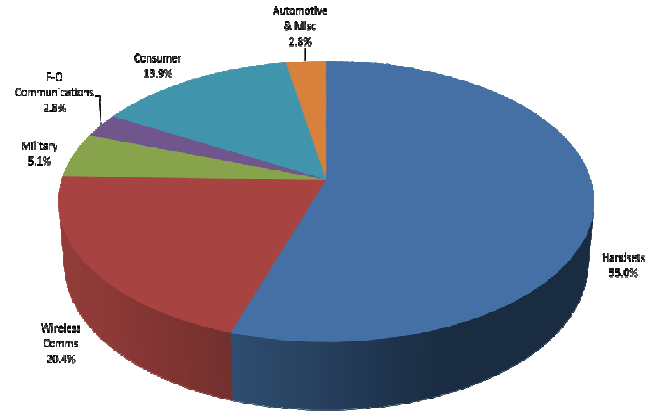


Figure 6. Segmentation of 2011 GaAs Device Revenue

Figure 6 breaks out handsets as a separate category to show their importance. The next largest segment is Wireless Communications and this includes Wi-Fi, point-to-point, commercial VSAT and wireless infrastructure. Combining these two segments puts the wireless portion of the total GaAs device revenue at slightly more than 75%!

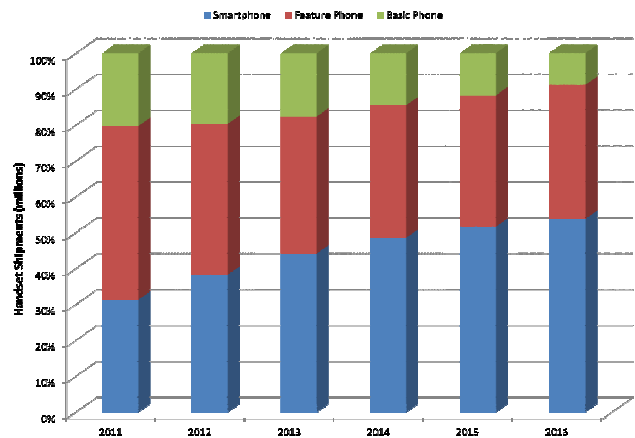


Figure 7. Handset Segmentation

Unfortunately, the news is not all positive. Figure 7 shows that the market share for multi-band mobile handsets, particularly smartphones is increasing. However, as smartphones increase in share, the rate of growth is decreasing. We believe a drop in the growth rate of smartphones in the second half of 2011 was the primary reason why the overall GaAs device market slowed. The slowing growth of these two segments, although still good also appears to have carried over into 2012. This has been a big contributor to slow growth in GaAs device revenue in 2012.

With the wireless segment accounting for 75% of the total GaAs revenue, it is not surprising to see that the market leaders are the companies most closely associated with wireless and handsets. Figure 8 shows our estimate of the 2011 market share of revenue for GaAs devices.

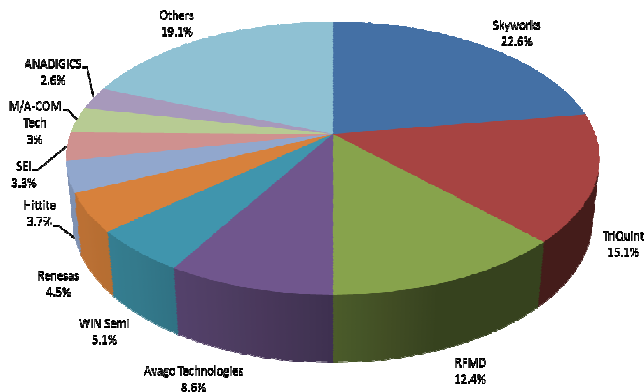


Figure 8. 2011 GaAs Device Manufacturer Market Share

Skyworks continues to outperform the market and they are increasing their lead. Since 2009, when Skyworks and RFMD were running close to one another, Skyworks has outpaced market growth with a diverse blend of products, technologies, customers and market applications. The other notable change in 2011 was TriQuint leaping over RFMD for second place. This came on the heels of essentially flat revenue at TriQuint, coupled with an almost 20% drop in revenue at RFMD.

A potentially troubling trend on the horizon is the development of multi-mode, multi-band (MM-MB) PAs to address the increasing number of bands. Given the price sensitivity of the handset market, these MM-MB PAs will undoubtedly be cheaper and potentially smaller than the sum of the devices they replace. While all the GaAs handset PAs manufacturers are designing MM-MB PAs and discussing design wins, there is still some question as to how quickly and broadly these amplifiers will be deployed. Among the issues to be resolved are optimizing efficiency and current consumption. If these challenges can be resolved, there is the potential for declining market revenue and wafer production just outside the forecast period shown in Figure 9.

After what looks to be relatively flat revenue growth in 2012, we anticipate the market starting to grow at a faster pace. We are forecasting a CAAGR of slightly more than 3% for revenue in the GaAs device market. The biggest driver for this growth will be the continued shift toward smartphones and their increased GaAs content.

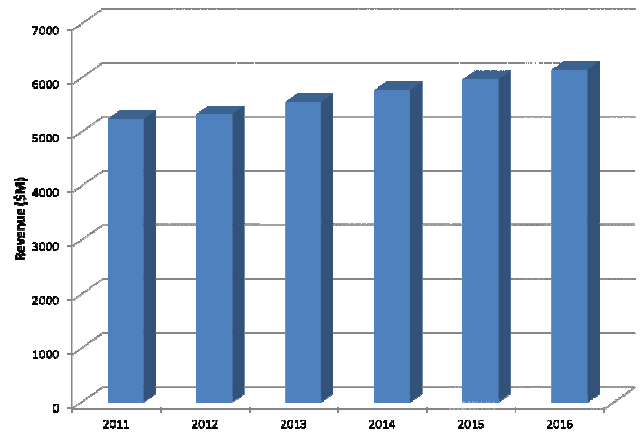


Figure 9. GaAs Device Market Forecast

## CONCLUSION

After a strong start to 2011, growth in the GaAs device market slowed substantially. An uncertain global economy, coupled with slowing growth of smartphone adoption has put a damper on the level of future growth in the industry, but there are positive signs. The fundamental driver of increasing data consumption remains and economic uncertainty has not slowed development activity. While we do not expect to see explosive growth, we believe growth rates in the GaAs industry will pick up in 2013 and beyond.

## REFERENCES

[1] Cisco, "Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2010–2015,"

## ACKNOWLEDGEMENTS

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## ACRONYMS

CAAGR: Compounded Average Annual Growth Rate  
 GaAs: Gallium Arsenide  
 HBT: Heterojunction Bipolar Transistor  
 IP: Internet Protocol  
 MBE: Molecular Beam Epitaxy  
 MOCVD: Metal Organic Chemical Vapor Deposition  
 PA: Power Amplifier  
 pHEMT: Pseudomorphic High Electron Mobility Transistor  
 SoI: Silicon-on-Insulator  
 VSAT: Very Small Aperture Terminal