RF GaN Market & Technology Trends

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Abstract

In the last years, the radiofrequency (RF) GaN market experienced impressive growth and has reshaped the RF power industry landscape. By the end of 2017, the total RF GaN market was close to $380M. The penetration rate in various markets, and in particular telecom and defense applications, had a breakout period in the last two years. The compound annual growth rate (CAGR) in these two markets is more than 20%.

Telecom and defense markets are definitely acting as the mainstay of this industry. The telecom market, thanks to the increasing development pace of 5G networks, will bring an interesting opportunity for GaN devices. We expect a significant boost to occur around 2019–2020, led by the implementation of 5G networks. The total RF GaN market size will be a factor of 3.4 larger by the end of 2023, posting a 22.9% CAGR from 2017-2023. Compared to existing silicon LDMOS and GaAs solutions, GaN devices are able to deliver the power/efficiency level required for next generation high frequency telecom networks. Also, GaN's broadband capability is one of the key elements for enabling important new technologies, such as multi-band carrier aggregation. GaN HEMTs have been the candidate technology for future macro base station power amplifiers.

We also believe most sub-6GHz macro network cell implementation will use GaN devices because LDMOS can no longer hold up at such high frequencies and GaAs is not optimum for high power applications. However, because small cells do not need such high power existing technology like GaAs still has advantages.

The defense market has been the major driving force for GaN development in the past decades. Originating in the US Department of Defense, GaN devices have been implemented in new generation aerial and ground radars. GaN's high power capability improves detection range and resolution, and designers are becoming increasingly familiar with this new technology. Nevertheless, this military-related technology is very sensitive. And as GaN devices are becoming popular in defense applications, the development of the nonmilitary part could be affected. This is especially true in terms of mergers and acquisitions. Governments could block deals if businesses target military applications, as in Aixtron's acquisition by FGC Investment Fund, or Wolfspeed's by Infineon.

GaN transistors price is still relatively high today. In a near future, more and more players should penetrate the market ensuring volumes increase and prices decrease. In parallel, the consulting company highlights significant issues related to the packaging. An effort in packaging could also strongly bring price reduction to an attractive level. Today, more players are choosing a plastic package: the industry is showing some movement on new types of packaging material and new die attach methods.

With important R&D investments, new packaging technologies in the package material and die attach will be more frequently used in higher-frequency and higher-power applications.

The ecosystem is growing with different GaN players such as Sumitomo Electric, Wolfspeed, Qorvo, M-A/COM, UMS, NXP, Ampleon, RFHIC, Mitsubishi Electric, Northrop Grumman, and Anadigics. We also find various business models at stake: IDM vs Foundry.

Regarding the technology platforms, different technologies are being implemented as GaN-on-SiC, GaN-on-Si and GaN-on-diamond. While GaN-on-SiC technology is more mature compared to others, Si substrates offers evolution to larger sizes and integration. Recently, Gan-on-Diamond has also attracted industry's attention owing to diamond's high thermal conductivity.

Conclusions

It is clear that the with the upcoming 5G network, we are entering an exciting new era of technology competition and breakthrough performance. This will seriously impact the future of this emerging wide band gap material, GaN.

References

[1] Yole Report: RF GaN Market: Applications, Players, Technology, and Substrates 2018-2023

Acronyms

CAGR: Compound annual growth rate
GaN: Gallium Nitride
LDMOS: laterally diffused metal oxide semiconductor
IDM: Integrated device manufacturer
LTE: Long term evolution
MIMO: Multiple input multiple output
PA: Power amplifier