

How will GaN and GaAs markets grow and compete?

Compound Semiconductor Quarterly Market Monitor – Q2, 2021, Modules I&II

WHAT HAS CHANGED SINCE Q1?

- SiC¹ & GaN² for power electronics:
 - SiC for next-generation premium EV³ models: there has been an acceleration in automotive design wins for main inverters, OBC⁴s and DC/DC converters. Leading SiC players are expecting several new design wins in upcoming quarters for high-volume platforms...
 - SiC also continues its penetration in industrial and transportation applications. Investment, capacity expansion and new arrivals in the global SiC ecosystem continue...
 - Chinese companies continue to adopt GaN fast chargers as a technology differentiator. GaN players enjoy steady growth with multiple design wins. GaN-based solutions have been also developed for datacom & telecom and automotive market segments.
 - GaN is also showing several notable investments in Q1-21.
- RF⁵ electronics:
 - 5G PAs⁶ start to strongly drive the GaAs⁷ RF market since H2-20: in 2020 the main development of handset solution is 5G-based.
 - GaAs supply chain: IDM⁸s, epihouses and foundries report strong revenue in Q1-21 which directly reflects the market dynamics
 - Continuing the increasing penetration of 5G phones in the smartphone market starting in Q4-20, GaAs RF market is still strongly driven by the handset applications, especially in China/Asia, North America and Europe.
 - GaN RF industry is facing uncertainty in terms of business visibility for H1-21. This is related to restrictions on Huawei.
 - RF GaN IDMs especially Qorvo continues achieving new design wins in the emerging 5G infrastructure market. 5G telecom infrastructure has been one of the killer applications

¹ SiC: Silicon Carbide

² GaN: Gallium Nitride

³ EV: Electric Vehicle

⁴ OBC: On-Board Charger

⁵ RF: Radio Frequency

⁶ PAs: Power Amplifier

⁷ GaAs: Gallium Arsenide

⁸ IDM: Integrated Device Manufacturer

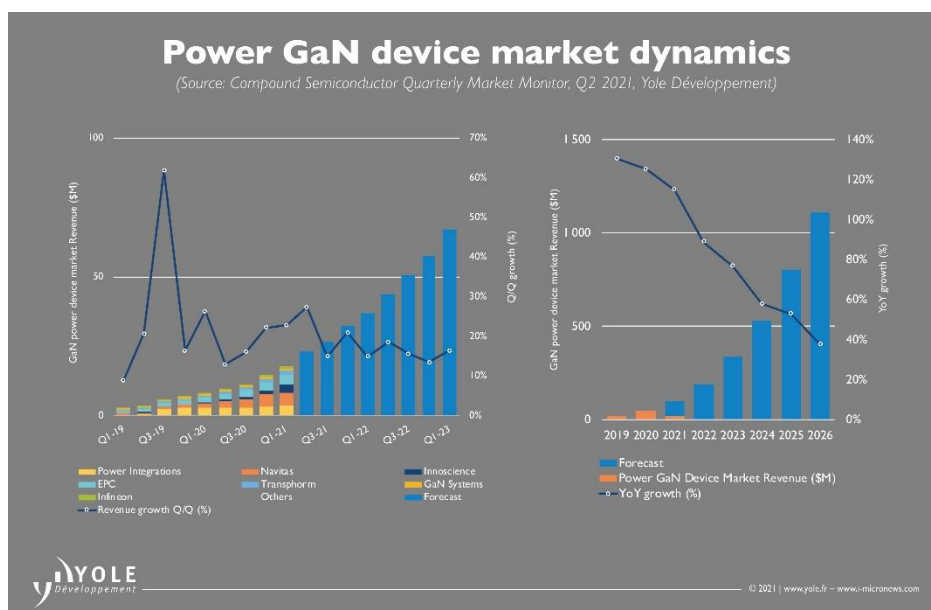
for GaN RF. GaN is also expected to make its entry in 5G Handsets in the upcoming years. Industrials should keep an eye on over the coming quarters...

POWER GAN REMAINS BUOYANT

“GaN power device revenue is forecast to grow from less than US\$50 million in 2020 to more than US\$1 billion by 2026 while the RF GaN market can also expect significant growth from US\$891 million to more than US\$2.5 billion in the same time-frame” writes **Ezgi Dogmus, PhD. Team Lead Analyst at Yole Développement (Yole)**. “Meanwhile, the RF GaAs bare die market is set to nudge US\$4 billion by 2026.”

But as new entrants jostle for attention in the power GaN market and additional capacity is rolled out for the RF GaN sector can the tried-and-tested RF GaAs segment hold onto its ample market lead?

Following a dip in quarterly revenue growth from 2019 to 2020, revenues have been steadily rising from Q2 2020 with many industry players making the most of the market revival.



As early as 2018, Ireland-based GaN semiconductor developer, Navitas Semiconductor was using GaN IC⁹s in its GaNFast smartphone fast chargers and since the end of 2020, many more industry players have followed this lead. For its part, Navitas recently joined forces with Live Oak Acquisition Corp, US, to go public in a SPAC¹⁰ deal valued at \$1.04 billion.

“This critical industry development follows in the footsteps of US-based business, Transphorm, which went public in 2020,” comments **Ahmed Ben Slimane, PhD. Technology & Market Analyst from Yole**. And he adds: “And now Navitas is ramping fast GaN charger shipments to the likes of Dell, Lenovo, LG and Xiaomi and more. “

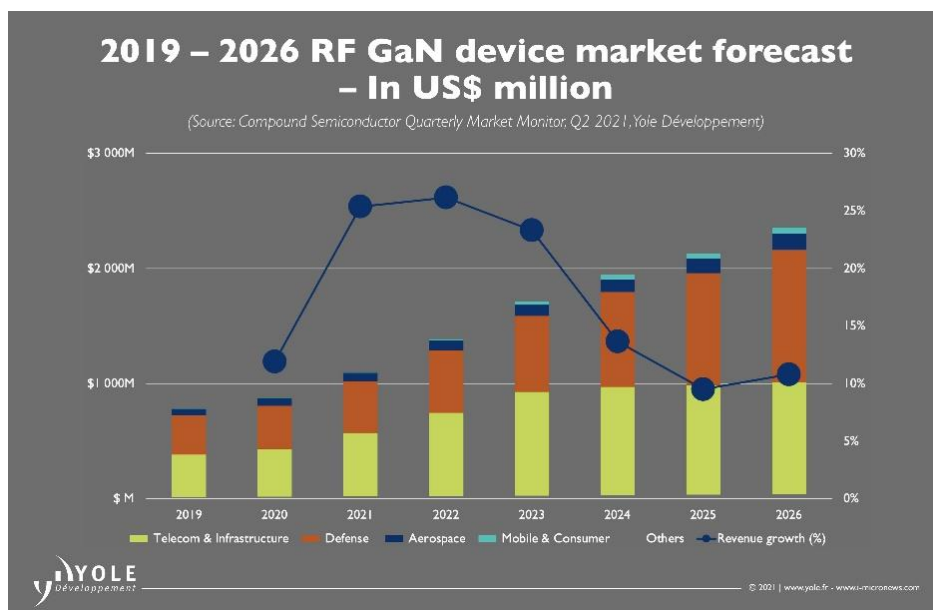
⁹ IC: Integrated Circuit
¹⁰ SPAC: Special Purpose Acquisition Company

The company also intends to extend its portfolio from fast chargers to datacoms, telecoms, e-mobility, industrial, energy and other applications, signaling strong market confidence.

In another positive move, US-based power IC business, Power Integrations, recently released the MinE-CAP IC for high power density AC-DC converters, adopted in the new Anker Nano II fast charger model. Targeting compact chargers and adapters, the IC shrinks the volume of AC-DC converters by up to 40%, raises efficiency, and importantly, increases the dollar content of GaN in devices, factors that can only help to raise Power Integration’s GaN market share...

THE GROWTH FOR RF GAN

As the RF GaN market continues to gather momentum, 5G telecoms and infrastructure remains a key driver for this market with high power, high bandwidth GaN components having penetrated base stations, remote radio heads and MIMO active antenna systems. Indeed, Yole estimates this market segment to exceed US\$1 billion by 2026, representing 42% of the entire market.



At the same time, the defense sector also continues to drive growth with applications expected to represent up to 48% of the entire market by 2026. GaN is being more widely used in lightweight transmit/receive modules for AESA radar airborne systems and is also deployed in fixed satellite communications.

Emerging applications include handsets and mobile satellite communications. Difficult GaN qualification may hinder the technology’s adoption in satellite communications, but this could change. For example, the European Space Agency is currently working with partners such as Airbus to develop GaN power amplifiers for antennae; and projects such as this will promote the adoption of GaN in space applications.

Still, the billion-dollar question for many in the RF GaN market is when will the technology truly find its way into consumer mobile handsets?

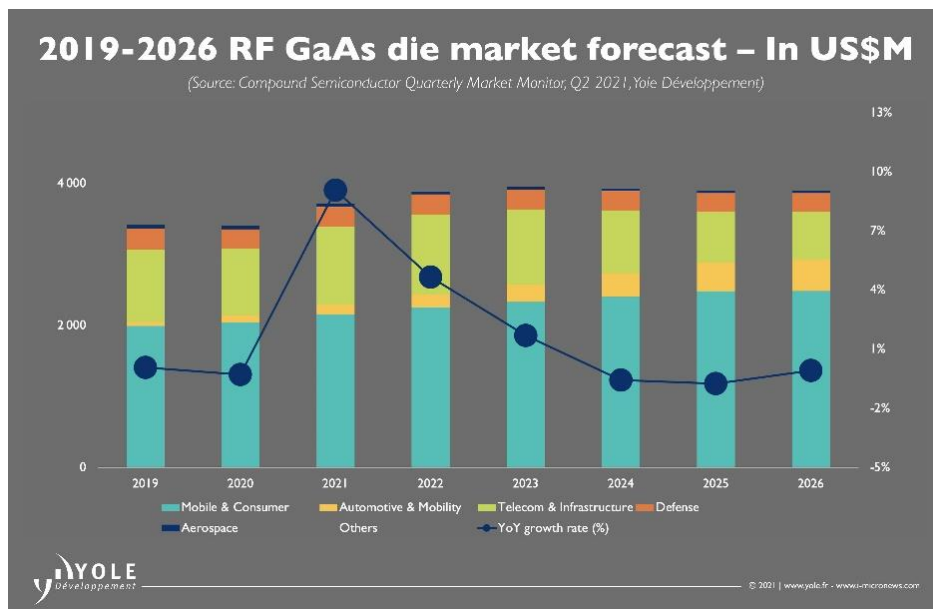
“Two years ago STMicroelectronics revealed it was working on GaN-on-silicon-based power amplifiers for handsets, and now a further major industry player has expressed similar interests,” explains **Poshun Chiu, Technology & Market Analyst at Yole**. “Given these market movements, Yole expects to see GaN power amplifiers being adopted in mobile and consumer applications from 2022.”

TECHNOLOGY CHOICES

“From word go, GaN-on-SiC has been the leading light in the RF GaN industry, having launched more than 20 years ago and now rivalling LDMOS and GaAs in RF power applications,” asserts **Selsabil Sejil, PhD. Technology & Market Analyst, part of the Compound Semiconductor & Emerging substrates team at Yole**. “Indeed, our figures indicate GaN-on-SiC will grow from US\$886 million in 2020 to US\$2.2 billion in 2026, with a 17% CAGR¹¹. “

RF GAAS HOLDS ON

What about RF GaAs? Despite facing competition to GaN and SiGe¹² in high power and high frequency applications, such as telecom and infrastructure, RF GaAs currently holds the largest market share by quite a margin – and this figure is set to grow.



With the launch of Apple’s iPhone 12 handsets to support 5G in 2020, the demand for GaAs is on the rise again, with the industry’s tried-and-tested compound semiconductor being a key building block in power amplifiers for sub-6GHz band. Along with the factor in the launch of WiFi 6 and WiFi 6E, handset connectivity from smartphone manufacturers keeps driving the

¹¹ CAGR: Compound Annual Growth Rate

¹² SiGe: Silicon Germanium

demands of RF GaAs. Yole predicts RF GaAs market share will edge towards a mighty \$4 billion from now until 2023. However, in telecom and infrastructure, GaAs is predicted to lose some of this market share to competing technologies such as GaN and SiGe...

Discover the full article, written by our Compound Semiconductor & Emerging Substrates team for i-Micronews. This article details Q2 results extracted from the Quarterly Market Monitor, Q2 2021.

Aim of the Compound Semiconductor Quarterly Market Monitor is to provide an in-depth coverage of rapidly changing market dynamics and main players' status and strategy. The market research and strategy consulting company is publishing its analysis every beginning of March (Q1), June (Q2), September (Q3) and December (Q4), with two modules:

- *Module I: GaN and SiC for power electronics applications*
- *Module II: GaAs and GaN for RF electronics applications*
- *Module III: GaAs and InP Optoelectronics (to be released in Q3-21)*

Stay tuned to i-Micronews to get further information about our Compound Semiconductor & Power electronics activities!

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About the compound semiconductor & emerging substrates team at Yole Développement

Ezgi Dogmus, PhD, is Team Lead Analyst in Compound Semiconductor & Emerging Substrates activity within the Power & Wireless Division at Yole Développement (Yole). She is managing the expansion of the technical expertise and the market know-how of the company. In addition, Ezgi actively assists and supports the development of dedicated collection of market & technology reports, monitor as well as custom consulting projects. Prior to Yole, Ezgi worked as a process development engineer for GaN-based RF and power solutions at IEMN (Lille, France). Ezgi has authored or co-authored more than twelve papers. After graduating from University of Augsburg (Germany) and Grenoble Institute of Technology (France), Ezgi received her PhD. in Microelectronics at IEMN (France).

Ahmed Ben Slimane, PhD is a Technology & Market Analyst, specialized in Compound Semiconductors and Emerging Substrates at Yole Développement (Yole). As part of the Power & Wireless team, Ahmed is contributing to the development of dedicated collection of compound semiconductors market & technology reports and monitor. Previously, he worked as an epitaxy (MBE/MOCVD) & fabrication process engineer for GaAs-based photovoltaic applications at TOTAL and IPVF (Paris-Saclay, France). Ahmed also completed his PhD in Material Engineering from KAUST (Saudi Arabia), where his mission was focused on GaN-based microstructures for flexible solid-state lighting. During his career, Ahmed Ben Slimane proposed lot of presentations towards an international audience. He authored/co-authored more than 20 publications in the semiconductor field and submitted a patent on the III-V hetero-structure for PV industry. Ahmed obtained his Master Degree in Electronics Engineering from INPG (Grenoble, FR).

Poshun Chiu is a Technology & Market Analyst specializing in Compound Semiconductor and Emerging Substrates at Yole Développement (Yole). As a member of the Power Electronics & Wireless division at Yole, Poshun focuses on power, RF, and opto-electronics. He is engaged in the development of technology and market reports and is also involved in custom projects. Before joining Yole, Poshun had 9 years' experience in R&D and product management at Epistar (TW & CHN). He is the author or co-author of more than 10 patents in solid-state-lighting. Poshun was also engaged in the development and evaluation of novel applications of process technology and components based on relevant semiconductor material systems Poshun received an MSc degree in Microelectronics from National Cheng Kung University (TW) and an MBA from IESEG School of Business (FR).

Selsabil Sejlil, PhD is a Technology & Market Analyst, specialized in Compound Semiconductors and Emerging Substrates at Yole (Yole). As part of the Power & Wireless team, Selsabil is contributing to the development of dedicated collection of compound semiconductors market & technology reports and monitor. Previously, she worked as an Integration Engineer for SOI products at SOITEC (Grenoble, France). She also worked in CEA as a process development engineer for 5G applications. Selsabil obtained her PhD. in Material Science from Claude Bernard University (Lyon, France) in collaboration with STMicroelectronics (Tours, France), where her works explored and optimized all the facets of the complete manufacturing of power electronic devices, with a focus on the optimization of SiC epitaxy. During her career, Selsabil SEJIL authored/co-authored more than 8 publications in the semiconductor field. Selsabil was graduated from University Paris Sud with a master's degree in NanoSciences (Orsay, France).

About Yole Développement

Founded in 1998, Yole Développement (Yole) has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering, and reverse costing services and well as IP and patent analysis. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 80 collaborators worldwide... [More](#)

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