UK Startup Dares to Innovate GaN Differently

I had the chance to interview Co-Founder and CEO Giorgia Longobardi and spoke to her about Cambridge GaN Devices' work in Gallium Nitride technology.

By Bodo Arlt, Publishing Editor, Bodo's Power Systems

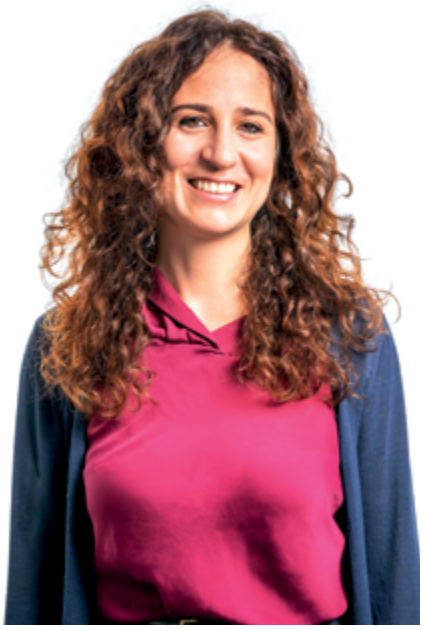
Bodo: Please tell us a little bit about Cambridge GaN Devices and how the company was founded!

Giorgia: Cambridge GaN Devices, or CGD, is a fabless semiconductor company created in 2016 to exploit the power of Gallium Nitride-based technology by delivering greener electronics. The company was spun-out of the engineering department at Cambridge University by myself and Professor Florin Udrea, which came about after 10 years of research into GaN. I was the first person in the department researching GaN alongside Florin in his group. At the time, he had more than 30 years of experience in power devices, not only in research, but also collaborating with some of the major semiconductor companies. Together we had a clear understanding of the technology and the challenges involved, such as reliability issues, and we had some ideas that could help solve this and more. Additionally, with the strong ecosystem in Cambridge, we decided that we had to start the company because of the impact GaN and its efficient technology could have on saving energy and improving power electronics going forward.

Bodo: What are some of CGD's biggest accomplishments since the company was founded?

Giorgia: Our goal was to explore and develop a number of unique opportunities in power electronics, and our team was able to accomplish that via our proprietary application of GaN to the silicon-based semiconductor transistor manufacturing process. Over the last few years, our engineers have developed GaN transistors that are over 100 times faster, lose 5 to 10 times less power, and are 4-times smaller than existing silicon equivalents. I'm so proud of the highly driven, committed, and knowledgeable team that we've built on our journey from a few sketches of ideas on pieces of paper to actively working to deliver the highest quality and highest performance semiconductor devices and integrated circuits for a new generation of power systems.

I'm also proud of the number of projects CGD has been involved in, including GaN Next, a €10.3m Europe-wide initiative developed through a consortium of 13 partners and led by our company. When we won the project, we had more partners than employees in the company, and that goes to show how ambitious we have been from the very beginning. We've quickly grown in numbers, and in terms of our IP portfolio we have now made 36 patent applications, including our proprietary ICeGaN™ technology.



Giorgia Longobardi

Bodo: Can you tell us more about your ICeGaN™ technology and how it works?

Giorgia: Our patented ICeGaN™ (Integrated Circuit Enhancement Mode GaN) technology, which is integral to our first product release due in the first half of 2022, is an integrated solution based on GaN with an intelligent and self-protecting mechanism that enhances the functionality of logic gates within a transistor. This merit is noteworthy on its own, for the reliability and scalability the technology offers, effectively enhancing the power efficiency of the devices.

ICeGaN™ allows us to drive CGD's GaN transistors with available gate drivers, normally utilised for Silicon transistors, while GaN-specific gate drivers and RC networks are needed to drive other GaN transistors. Moreover, CGD embeds into its GaN transistors dedicated ICs which deliver additional essential functions for the power supply such as overcurrent protection, temperature sensing and over temperature protection. This is why we refer to an ICeGaN™ powered product as a GaN power IC rather than simply a GaN transistor.

Bodo: What makes CGD different from other semiconductor companies?

Giorgia: One of the key factors that differentiates us from others is how we've identified what is called the 'third way' in GaN power devices and has been made possible by doubling down on our ICeGaN™ technology. Our company has been able to integrate the smartness needed for the transistor and make it easy to use, while giving any customer the flexibility to use any gate

Team Cambridge GaN Devices

driver. Basically, ICeGaN™ technology merges the positive of Cascode configuration (ease-of-use) with the beauty of eMode HEMTs (single chip, normOFF), as well as a number of integrated smart sense and protection features. This is quite unique as it provides a reliable transistor, but it is also scalable in power and in voltage. ICeGaN™ technology is deployed into a portfolio which will grow to cover Consumer and Industrial applications, from 30W mobile chargers all the way to multi-kW servers, telecom rectifiers and PV inverters, with an eye towards Automotive applications at the right point in time. We're the only company that has such flexible technology right now.

We're also different thanks to the innovative approach to everything that we do and having a constant eye on the future. Our expertise in GaN is strong thanks to our deep knowledge of the material, the device physics, as well as the system and market requirements which puts us in the unique position of being flexible and able to move quickly once we have shared with the market and our customers. We're extremely committed to not only delivering a green product, but to be a company that has embedded sustainability in its own culture with the entire team committed to the journey ahead.

Bodo: Which applications/markets do you intend to make your products available for?

Giorgia: We're in the process of developing a range of energy-efficient GaN-based power devices using ICeGaN™ technology and are looking to deploy it in several key market segments such as consumer electronics, lighting, data centres, telecoms, solar and automotive electric and hybrid electric vehicles. Our company recently commenced an Innovate UK (the UK government's innovation agency) project with the goal of developing a product for the automotive market as this is a key market to meet our business objectives. We've also just launched ICeData, a project aiming to develop and commercialise a highly efficient GaN-based IC for use in data centre server power supplies. The primary goal of this project will be to deliver state-of-the-art GaN power IC technology to boost the efficiency of data centre server power supplies to more than 97 percent, which will contribute to the saving of more than 8 megatons of CO_2 emissions annually in 2030.

Our GaN-based transistors can provide other power saving benefits, such as decreasing the amount of power needed for typically power-hungry data centres, or when it comes to consumer electronics opening up the potential for smaller, energy-efficient components, changing the game in a positive way for the world at large. As sustainability is a core tenet of our business, the idea here is to bring our innovative solution with the aim of continuously lowering power losses in the electronic power industry to benefit a wide community of customers and end users.

Bodo: What can we expect from CGD in 2022 and beyond?

Giorgia: 2022 is set to be a big year for the company. We've already unveiled a rebrand of the company to better communicate our approach in changing GaN technology. We also launched the ICeData project, and at APEC we'll be announcing the launch of our first product for the market. We also have a number of client engagements in the pipeline, including partnerships with major companies that are soon to be finalised. We are also in ongoing discussions with various customers, including some that have expressed interest in our technology with some initial design-in work taking place, from which there will be soon-to-be-announced business wins.

CGD will continue to invest heavily in R&D across the various markets we've targeted as we aim to become the market leader in GaN power integrated circuits and wish to demonstrate to all that efficient power electronics is a key piece of the puzzle for the world to reach its net zero targets. We also plan to significantly expand our team over the next few years as we continue to innovate and push forward on R&D activities via strategic partnerships that will take the company to the next level.

Bodo: Thank you very much, I will keep my eyes open for more to come from CGD!

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