

Navitas Quality & Reliability Series Article #1 (Intro)

Electrifying Our World™: The Navitas Quality Journey

Delivering GaN Quality and Reliability at Scale Across a Growing Range of Powers and Applications

“Consistently delivering reliable GaN technology at scale and ever-increasing power ratings requires an application-focused, design for reliability approach combined with quality suppliers, comprehensive testing, continuous and exhaustive validation, and strong customer collaboration and co-development.”

- Anthony Schiro – VP Quality



It is only natural that when adopting any new technology that customers will seek assurance regarding quality and reliability. In delivering this assurance, how a company is built, the experience of its people, its culture and values are just as important as how the technology is designed, manufactured, tested and deployed. Certainly, these factors have all played a key role in driving the quality and reliability that Navitas customers have come to expect as Navitas has moved gallium nitride into the mainstream. Here, and in subsequent articles, we will recount the journey to achieving our industry-leading quality and reliability.

The starting point for our journey is experience. Take the [leadership team at Navitas](#), for example. This team has over 300 years of combined power semiconductor experience, had amassed more than 200 industry patents and was responsible for at least twenty generations of power semiconductors before founding Navitas. Since then, Navitas has an additional 130 patents granted or pending.



Figure 1: Over 130 patents and significant company secrets give Navitas a multi-year lead in gallium nitride

This experience has been fundamental to building a company that is at the forefront of a second power revolution - helping customers address design and sustainability goals by migrating from slower, legacy silicon semiconductors to faster, more efficient [gallium nitride](#) (GaN)-based solutions.

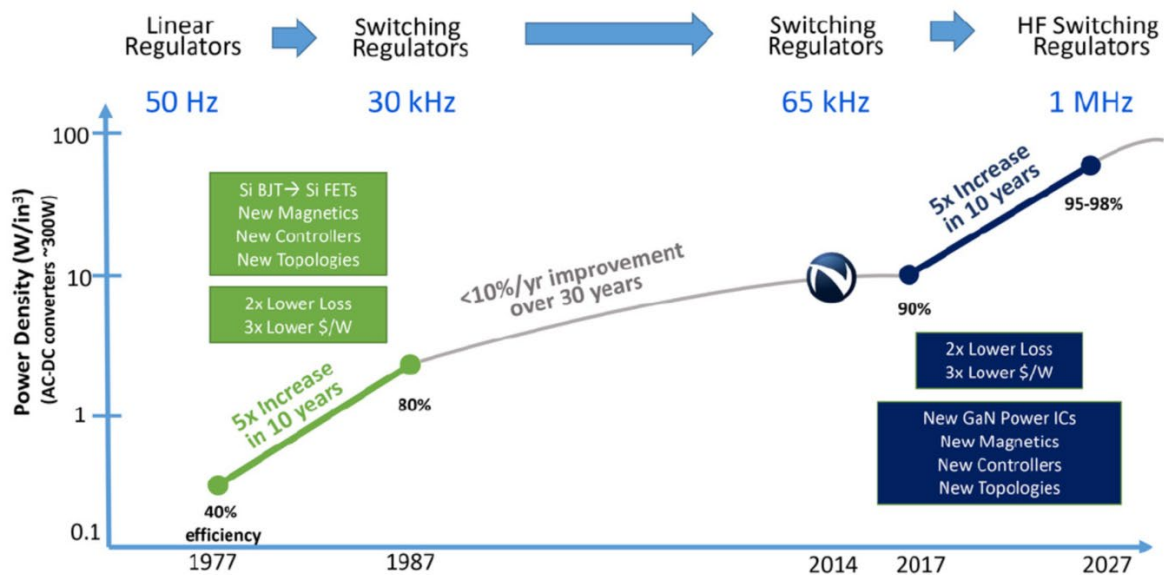


Figure 2: Navitas GaN technology is at the forefront of the second power revolution

From this standpoint, the first step on the quality journey is understanding how to use a new technology to define products that are low risk to the customer. This means designing for quality and reliability from the outset and, in the case of Navitas, maximizing levels of integration to minimize potential points of failure at a product level and at the system level. Such quality-oriented design clearly demands technology expertise and a full understanding of the requirements of the target applications.

The next step is internal validation of the technologies and products through qualification, test-to-failure and lifetime analysis techniques, after which it is possible to partner with customers to demonstrate the disruptive performance and low risk. Only when all this is done can the ramp-up to high-volume production begin. Then, once product quality is proven in one market, it becomes possible to use that benchmark reliability as the basis for expanding into other application areas.

The Navitas Quality Philosophy

The Navitas quality philosophy is built on six fundamental elements:

- Exceed customer expectations by defining products with quality and reliability designed in
- Collaborate with customers to co-develop quality-optimized system solutions
- Partner with key suppliers to jointly develop processes that ensure quality and reliability
- Develop critical and proprietary testing techniques that are optimized for the new technology and target applications
- Continuous and exhaustive qualification, validation and monitoring with a constant risk identification and mitigation focus
- Demonstrate benchmark reliability customer by customer, application by application and market by market



Figure 3: Six key elements of the Navitas quality philosophy

Delivering quality and reliability at scale demands that companies challenge themselves to be both innovative and curious when it comes to risk identification and mitigation. This means thinking of quality as more than simply following a standard.

For example, at Navitas, developing a robust process control plan and the effective use of design and process failure-mode and effects analysis (FMEA) is not about just using or following the quality tool or quality standard. It is about capturing risks to product performance or product variation in order to ensure we provide the best possible product for the customer and reduce the customer's risk of implementing a brand-new technology. This is particularly true when it comes to newer disruptive technologies such as GaN, since legacy standards are unlikely to have been designed with the capabilities of these older technologies in mind.

In addition to looking at quality and reliability at a device level, it is also important to consider the overall customer problem that needs to be solved and how the devices will work in the context of the final application. It is only with such an approach that customers can have the confidence that replacing legacy silicon with GaN will not compromise – and can actually improve – quality and reliability.

That's why Navitas not only puts effort into developing advanced GaN technologies that are inherently more reliable than legacy silicon but also considers 'the bigger picture' - how to address the challenges that customers face around improving performance and saving power in their applications. Because addressing these challenges not only plays a part in realizing optimized designs but ensures better use of global energy resources while minimizing the impact of greenhouse gases on the planet. This is only possible by becoming experts at the system level and then using that expertise to define and drive the design of revolutionary products.

Gaining Customer Trust by Minimizing Risk

From the outset, Navitas made some critical decisions that determined the company's ability to gain trust and provide peace of mind as customers looked to transition from a 40-year old incumbent technology that could no longer meet performance, efficiency and size goals. These ranged from choice of technology and manufacturing partners to an approach to product design that would ensure a flawless launch into the market. Under-pinning all of these decisions has been a focus on how to reduce risk, how to ensure a robust product for the customer and how to continuously improve through risk identification and mitigation.

In recognition that existing test methodologies were not designed with the superior performance of GaN in mind, for example, it was seen as important to combine industry-standard validation testing with proprietary product and reliability methods focused on high-frequency switching and testing that mimics the target applications. This helped to eliminate the risk of adopting the new technology by making it possible to push the envelope on performance while ensuring quality and reliability levels equal to or greater than those associated with legacy silicon in those applications.

This advanced later testing became part of a new industry-wide standard when Navitas were founder members of the [JEDEC JC70.1](#) GaN standards committee.

The proactive diligence and execution of engineering and operations teams has been an absolutely-essential element of successfully ramping from initial launch to high-volume production, as was a company culture built around quality as a fundamental. Such a 'quality culture' is about who you are, what you believe in and how you act. It takes experience, expertise and determined action to seek out risks and address them.

In the case of Navitas, this means not only proving the quality of the products, but the quality of each new aspect of the high-frequency, high-density power supply ecosystem in which those products are deployed.

A key aspect of the approach involves collaborating with customer engineering and manufacturing teams to challenge the status quo, jointly agree system level goals (often beyond the industry standards) and work together to exceed minimum requirements prior to launching into mass production.

A Holistic Approach to Quality and Reliability

To be at the forefront of the second revolution in power semiconductors requires a holistic approach to pushing current technology boundaries while launching every new product to market safely. The Navitas philosophy is to build customer confidence step-by-step by carefully planning product evolutions that are based on experience and real-life reliability data. As the world's leading GaN power IC company, Navitas has an unrivalled dataset based on more than 25 million shipped devices and over 68 billion field use hours as of August 2021 (for up-to-date quality metrics please [click here](#)). This dataset provides customers across all markets with proof of the effectiveness of the company's approach to quality and reliability. It also provides the confidence to take the next steps of the GaN journey.

Having delivered proven and reliable solutions at the lower end of the power spectrum (from 45W, then 65W, then 120W, then 240W, etc.), Navitas and its partners can be confident of pushing to the next power levels. As a result, whether it's enterprise servers, electric vehicles or renewable energy, applications in the highest power sectors will benefit from the supply, at scale, of high-performance, ultra-efficient, reliable GaN ICs.

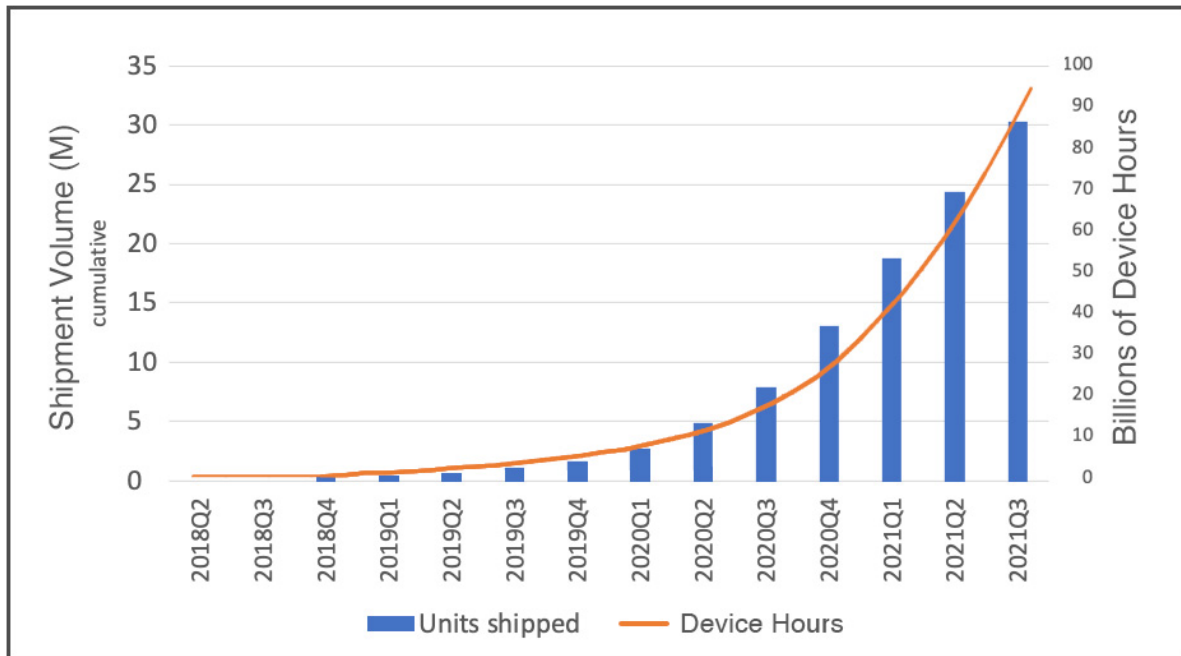


Figure 4: Navitas has shipped over 30 million GaNFast power ICs and amassed more than 90 billion hours of field data

A few charts and graphs are not enough to explain the premium that Navitas places on reliability and how quality is baked into the very core of the company and the values it holds. But the results of this culture are clear to see in the journey from the company’s creation in 2014 to a position where, as of August 2021, over 25 million Navitas GaNFast power ICs have been shipped with no GaN defects reported in the field.

Stay Tuned for More on Navitas Quality and Reliability

In the coming weeks we’ll publish more articles on the Navitas approach to quality and reliability with topics that cover the benefits of integration, critical design and supplier choices, qualifying a revolutionary technology, maintaining a risk reduction focus through a steep production ramp and the importance of customer engagement and partnership.

Useful links:

[Navitas up-to-date quality data](#)

[What is gallium nitride?](#)