



New Transphorm White Paper: Normally-Off D-Mode GaN Advantages Vs. Normally-Off E-Mode GaN

September 6, 2023

Robust GaN Power Semiconductor Leader Maps Out How Its Normally-Off D-Mode Platform Design Harnesses GaN's Natural Benefits, Whereas Competitive E-Mode Designs Must Make Performance Compromises

GOLETA, Calif.--(BUSINESS WIRE)--Sep. 6, 2023-- [Transphorm, Inc.](https://www.transphormusa.com) (Nasdaq: TGAN), a global leader in robust GaN power semiconductors, announced the publication of its latest white paper titled *The Fundamental Advantages of D-Mode GaN in Cascode Configuration*. The paper provides a brief tutorial on the inherent benefits delivered by a cascode (normally-off) d-mode GaN platform. Importantly, the paper continues to explain how e-mode platforms by their very nature (physics) ultimately diminish some of those inherent performance benefits to deliver a normally-off solution. The paper is available for download here: <https://bit.ly/wpdmodegan>.

Key White Paper Takeaways

The paper demonstrates several key advantages achieved by the normally-off d-mode GaN platform including:

1. **Enabling higher performance:** Superior TCR (~25%) and lower dynamic to static on-resistance ratio (~25%) leading to lower loss/higher efficiency and better figure-of-merit (FOM).
2. **Easily operating at higher power levels:** higher saturation current with Transphorm d-mode, whereas e-mode must be paralleled to achieve same amps (which causes reduced power density and reliability).
3. **Robust and easy drivability:** most robust gate using a silicon MOSFET SiO₂ gate interface without the p-gate limitations of e-mode, compatibility with silicon-based drivers and controllers.

"There's long been a debate in the wide bandgap industry about which solution is better. Normally-off d-mode GaN or e-mode," said Philip Zuk, SVP, Business Development and Marketing, Transphorm. "We explored both options when we first came to market and opted for a normally-off d-mode solution because it was the most reliable option with the highest performance, and widespread driver compatibility. It also provided a comprehensive long-term roadmap with system design capabilities that we've yet to see e-mode repeatedly demonstrate. This paper aims to clearly explain why we design our GaN the way we do to help customers better understand what they are getting when they choose their GaN devices."

For over a decade, Transphorm has successfully led the industry with the most reliable GaN platform—now with over 200 billion hours of field operation—supporting the widest range of applications, from low to high power systems. The company was first to achieve JEDEC qualification. First to achieve AEC-Q101 (automotive) qualification. First to release a 900 V platform. And is currently developing its demonstrated 1200 V platform for 800 V electric vehicle battery applications.

Transphorm has demonstrated a four-quadrant switch that helps to reduce part count by two to four devices in targeted designs including microinverters and bidirectional systems. And, it has demonstrated short circuit withstand times (SCCL) of 5 microseconds opening up multi-billion-dollar markets of motor control and electric vehicle powertrain applications.

With its comprehensive product platform, the company has achieved design ins and production ramps in customer products ranging from the 10s of watts up to 7.5 kW in applications ranging from Computing (datacenter and networking power supplies, high performance gaming, blockchain, AI computing), Energy/Industrial (mission critical UPSes and microinverters), and consumer adapters/fast chargers (laptop, mobile, appliances). The company credits it all to its initial normally off d-mode design choice put in the hands of its customers.

White Paper Synopsis

Overall, the paper addresses what GaN naturally brings to the table physics-wise. And how a normally-off d-mode GaN solution maximizes those inherent benefits to create a superior platform with greater reliability, designability, drivability, manufacturability, and versatility.

Specifically, the paper explores the role of the 2-dimensional electron gas channel (the 2DEG), a natural phenomenon that spontaneously forms in the GaN HEMT stack. As all GaN platforms (including e-mode) are normally-on d-mode platforms at their core—the paper will go on to examine how the 2DEG's and the overall platform's performance is affected depending on whether a d-mode or e-mode based approach is chosen to switch the platform off.

Lastly, select myths about normally-off d-mode and e-mode device performance will be addressed.

White Paper Access

The paper is available for free and can be downloaded here: www.transphormusa.com/document/wp-dmode-gan-advantages.

About Transphorm

Transphorm, Inc., a global leader in the GaN revolution, designs and manufactures high performance and high reliability GaN semiconductors for high voltage power conversion applications. Having one of the largest Power GaN IP portfolios of more than 1,000 owned or licensed patents, Transphorm produces the industry's first JEDEC and AEC-Q101 qualified high voltage GaN semiconductor devices. The Company's vertically integrated device business model allows for innovation at every development stage: design, fabrication, device, and application support. Transphorm's innovations move power electronics beyond the limitations of silicon to achieve over 99% efficiency, 50% more power density and 20% lower system cost. Transphorm is headquartered in Goleta, California, and has manufacturing operations in Goleta and Aizu, Japan. For more information, please visit www.transphormusa.com. Follow us on Twitter @transphormusa and WeChat @ Transphorm_GaN.

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