



COMPARATIVE STUDY OF E-GAN FETS FOR HIGH POWER AND FREQUENCY WIRELESS POWER TRANSMISSION

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Abstract

This research provides a comparative study between the use of a parallel switch configuration of a lower current rating eGaN device (GS66508T) versus a single higher current rating eGaN device (GS-065-060-5-T-A) operating at 13.56 MHz in a 1 kW class ϕ 2 inverter targeted for wireless power transfer (WPT) systems. The performance of both the topologies and devices has been evaluated in LTSpice.

Motivation and Background



Photo by CoreTigo

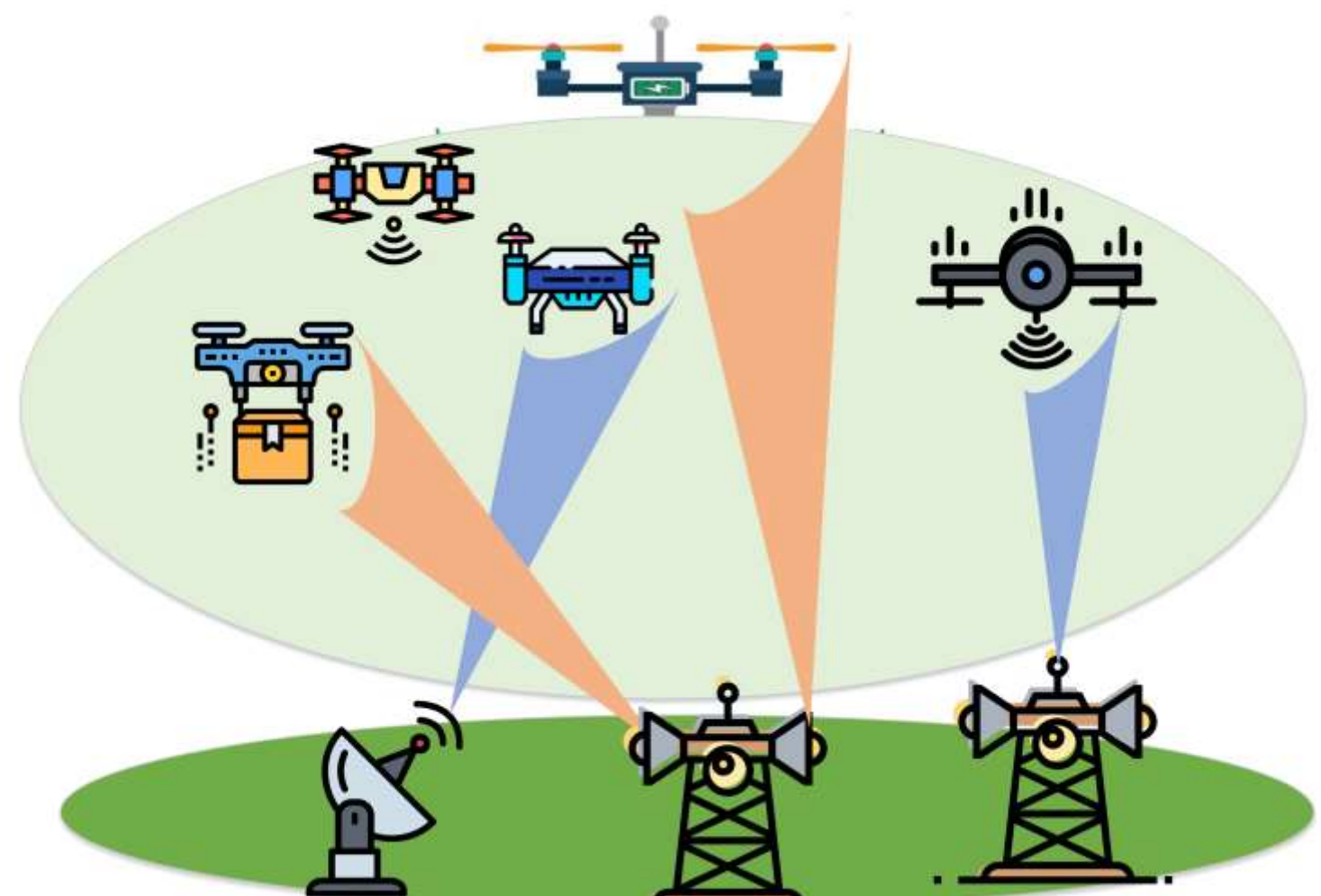
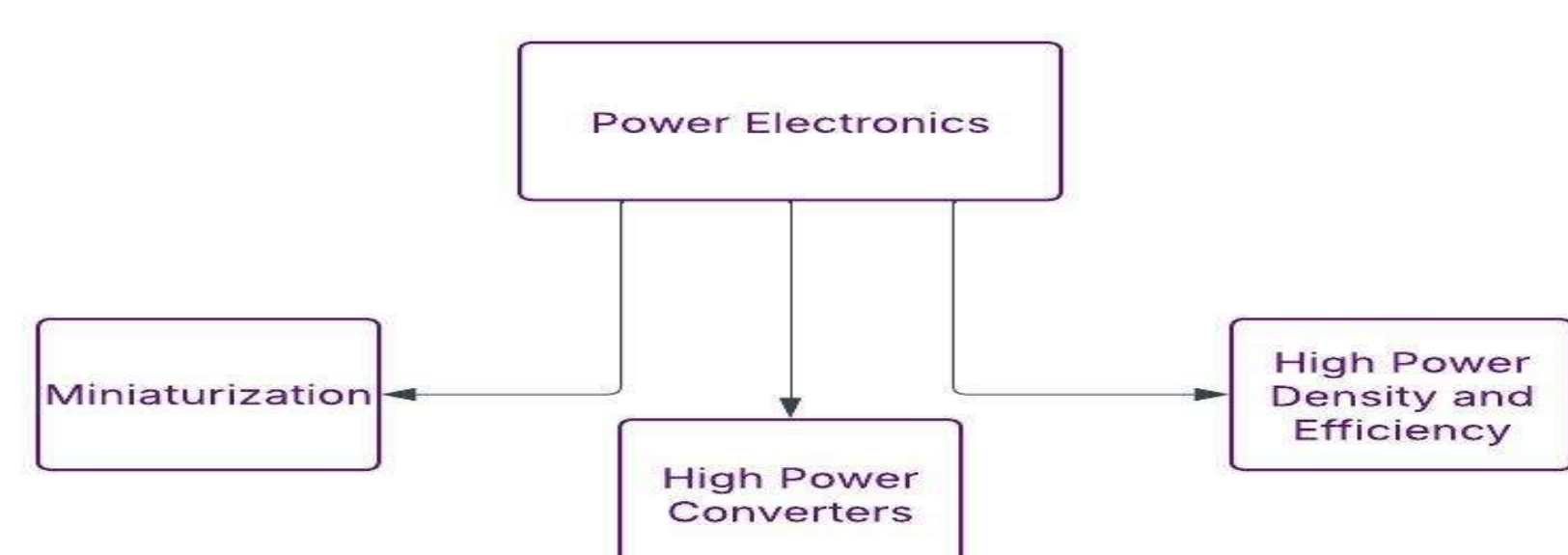


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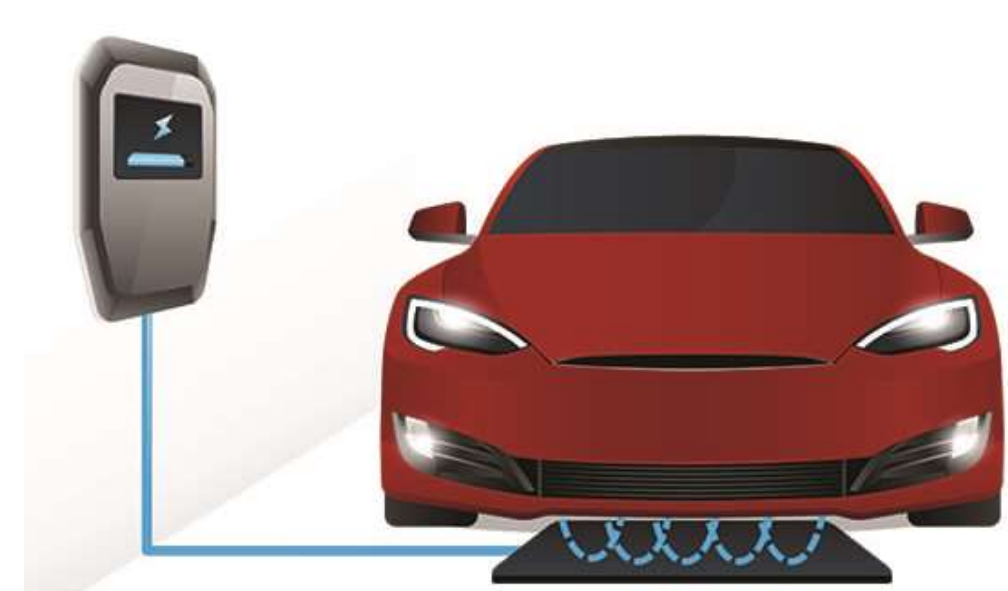


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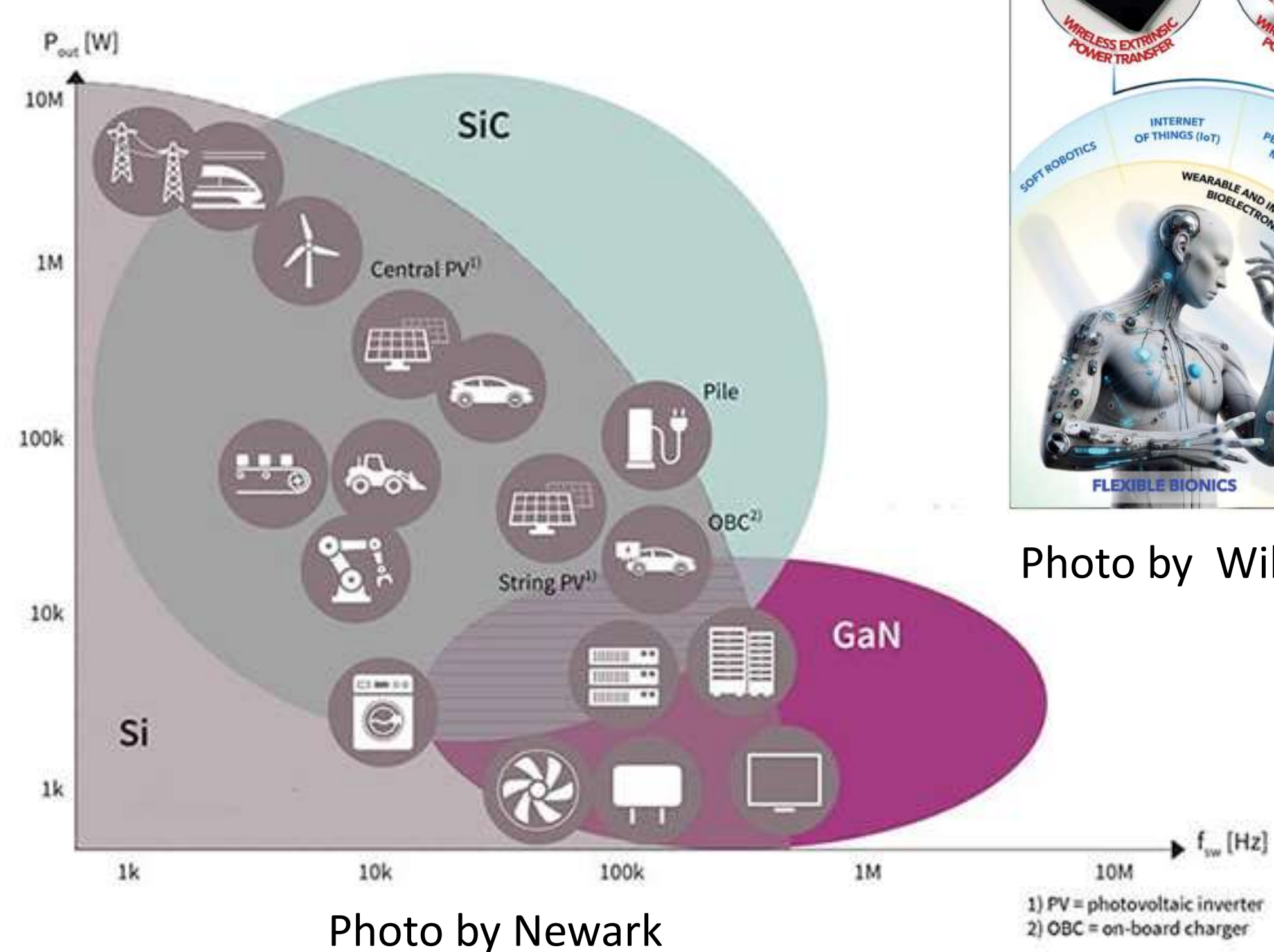
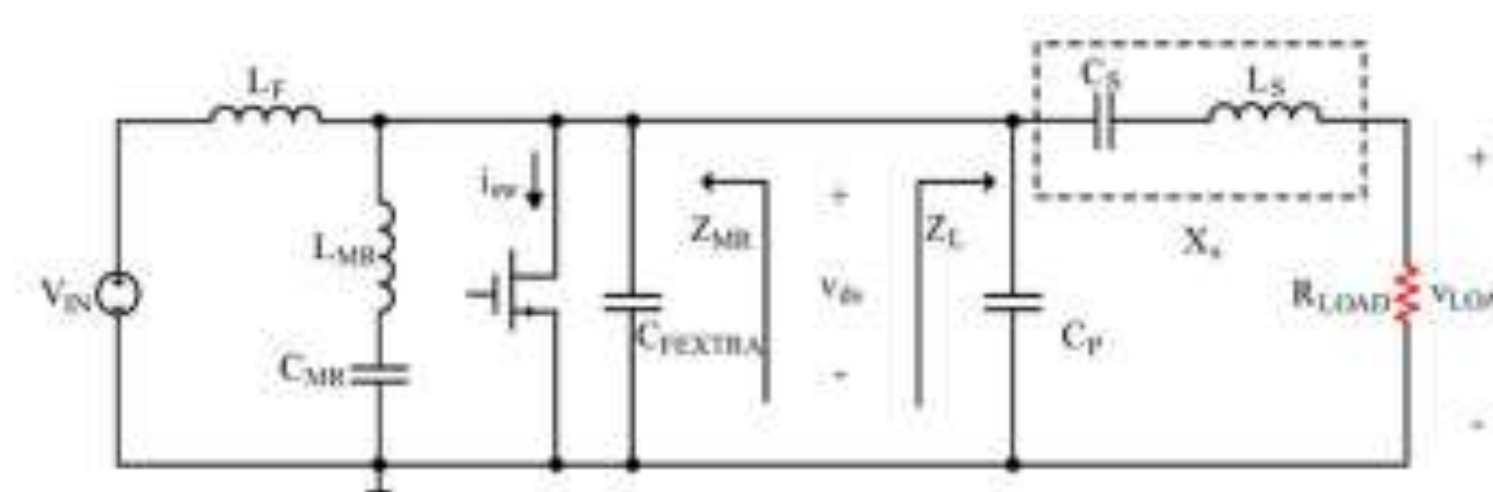


Photo by Newark

1) PV = photovoltaic inverter
2) OBC = on-board charger

The Class Phi-2 Converter

- Demonstrates low semiconductor voltage stress, small passive energy storage requirements, fast dynamic response, and good design flexibility.
- Suitable for high frequency (HF) and VHF operations due to soft switching characteristics.

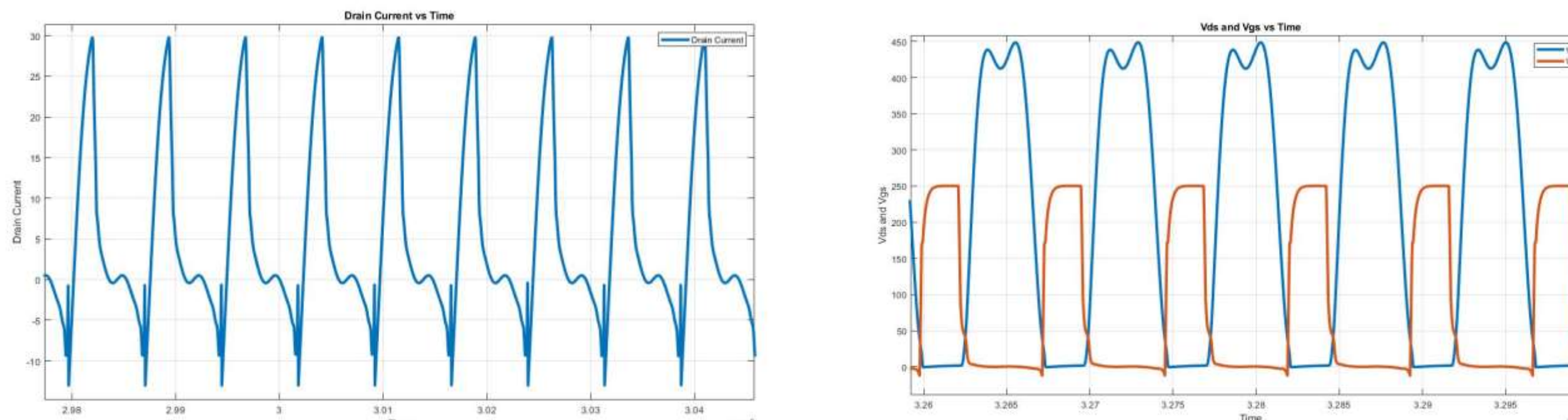


The Study and Results

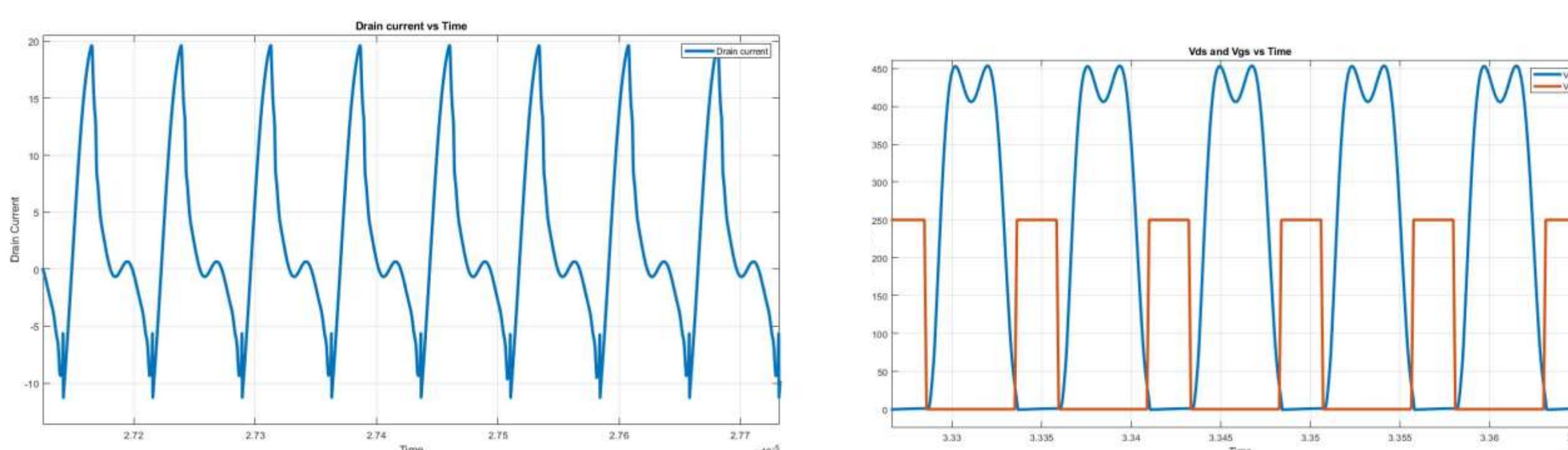
- Comparison of the 2 eGaN FETs.

Feature	GS66508T	GS-065-060-5-T-A
Voltage Rating	650V	650 V
Current Rating	30A	60A
Coss	65pF	127pF
Rise and Fall Time	3.7ns and 5.2ns	8.5ns and 7.7ns

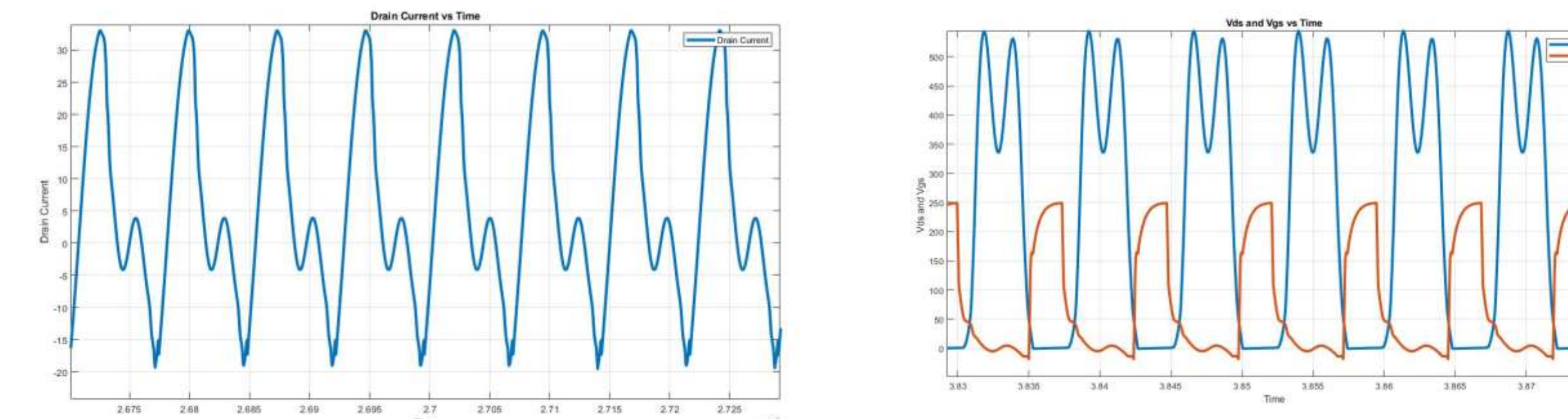
Single switch GS66508T for 216 V, 1kW power design



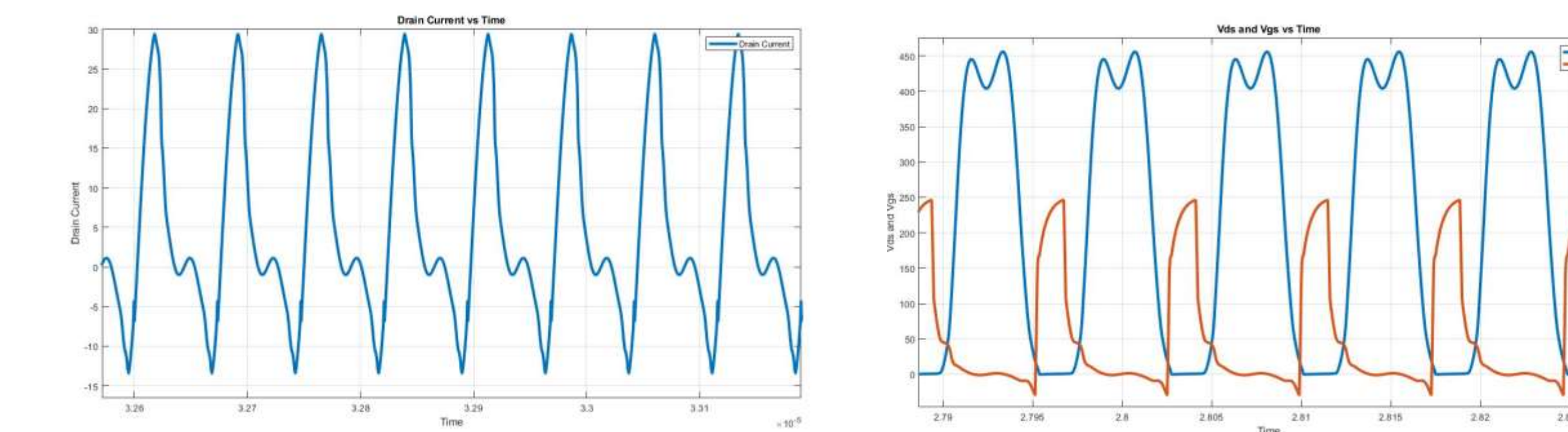
Parallel configuration with GS66508T



. GS-065-060-5-T-A reduced Cp



. GS-065-060-5-T-A reduced duty cycle



A Brief Summary of the 3 Topologies

- This table summarizes the 3 topologies :

Parameters	Parallel with GS66508T	GS-065-060-5-T-A reduced Cp	GS-065-060-5-T-A reduced duty cycle
Duty	30%	30%	30%
Efficiency	92.4%	92.2%	97.2%
Switch Loss	5.06	30.74	92.46
Duty	20%	20%	20%
Efficiency	92.2%	92%	92.9%
Switch Loss	5.99	31.6	20.46%
Possible Drawback	Can be tricky to operate because high chance of one device getting damaged.	Higher peak across Vds can damage the device	High efficiency above 90% not obtained for conventional 30% duty cycle

Future Work, References, and Acknowledgments

- Design PCB for parallel switch configuration for GS66508T
- Design PCB for GS-065-060-5-T-A
- Conduct experiments to validate LTSpice simulation results

Faculty: Jungwon Choi

- [1] J. M. Rivas, Y. Han, O. Leitermann, A. D. Sagneri and D. J. Perreault, "A High-Frequency Resonant Inverter Topology With Low-Voltage Stress," in IEEE Transactions on Power Electronics, vol. 23, no. 4, pp. 1759-1771, July 2008.
- [2] GS66508T, 650V Enhancement Mode GaN Transistor. [Online]. Available: <https://gansystems.com/gan-transistors/gs66508t/>
- [3] GS-065-060-5-T-A, 650V Enhancement Mode GaN Transistor. [Online]. Available: <https://gansystems.com/gan-transistors/gs-065-060-5-t-a/>