

## **Emerging Applications for GaN Transistors**

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Enhancement mode gallium nitride transistors have been commercially available for over three years and have infiltrated many applications previously monopolized by the aging silicon power MOSFET. In this paper we will show the benefits derived from the latest generation eGaN® FETs in emerging high frequency applications such as wireless power transmission, RF envelope tracking, and high frequency resonant DC-DC conversion. We will also discuss the benefits from gallium nitride transistors in traditional applications such as radiation hardened power supplies and Class-D audio amplifiers. All cases support the rapidly evolving trend of conversion from power MOSFETs to gallium nitride transistors.

Thirty years of silicon power-MOSFET development taught us that one of the key variables controlling the adoption rate of a disruptive technology is whether or not the product is easy to use and enables new applications. Wireless energy transfer is a relatively new field gaining popularity in many commodity products such as mobile phones chargers. Many of the wireless power solutions have focused on induction coil solutions with operating frequencies around 200 kHz, and Class E, F and S amplifier converter topologies. Recently, however, there has been a push for operation in the lower ISM band at 6.78 MHz where traditional MOSFET technology is approaching the limit of its capability. eGaN FETs offer an alternative to MOSFETs as they can switch fast enough to be ideal for wireless applications.

A second application example where eGaN FETs offer a distinct advantage over existing silicon technologies is RF envelope tracking. The potential efficiency and operating cost improvement of envelope tracking (ET) – the modulating the supply voltage of radio frequency power amplifiers (RFPAs) – is well known. With today's high peak-to-average-power-ratio (PAPR) requirements, the average RFPA efficiency is likely to be as low as 25%. Through ET, this can be improved to over 50% but requires a high bandwidth power-supply [1]. In this paper we demonstrate what switching frequencies, power levels and efficiencies are readily realizable using current eGaN FETs.

We will also look at the benefits of eGaN FETs in high frequency resonant DC-DC converters. The intermediate bus architecture (IBA) is popular power system architecture in computing and telecommunications equipment. The majority of today's bus converters use traditional hard switching bridge topologies operating at lower frequencies. However, in an effort to improve power density, the operating frequency can be increased to shrink the inductor and transformer size <sup>[2]</sup>. To offer improved efficiency at higher switching frequencies, resonant topologies may be considered. Resonant topologies [3]-[6] are particularly beneficial

in DC/DC transformer applications, due to the removal of the regulation requirement, allowing the converter to always operate at the resonant frequency. We will demonstrate the benefits of eGaN FETs in an isolated high frequency 48 V intermediate bus converter with a 12 V output utilizing a resonant topology operating above 1 MHz.

## REFERENCES

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