



**The eGaN<sup>®</sup> FET  
Journey Continues**

# **Driving eGaN<sup>®</sup> FETs in High Performance Power Conversion Systems**

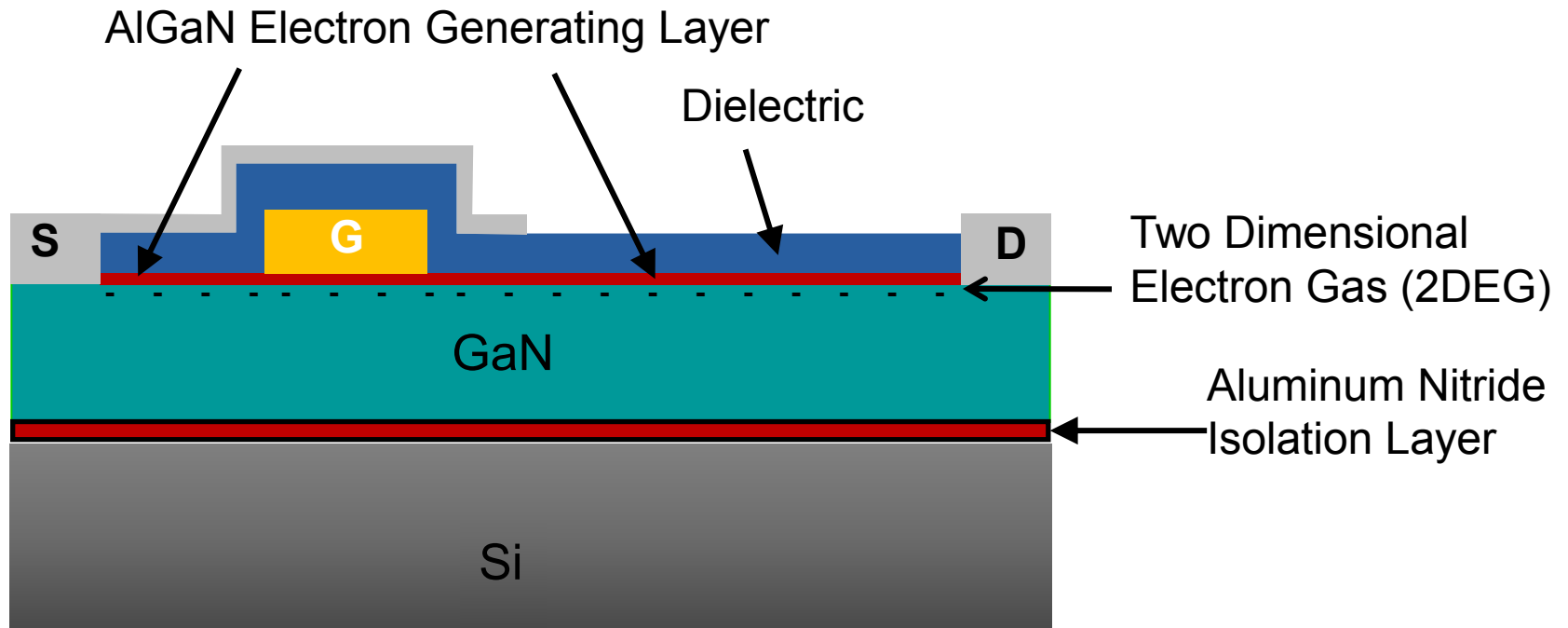
**Alexander Lidow PhD**

*Efficient Power Conversion Corporation*

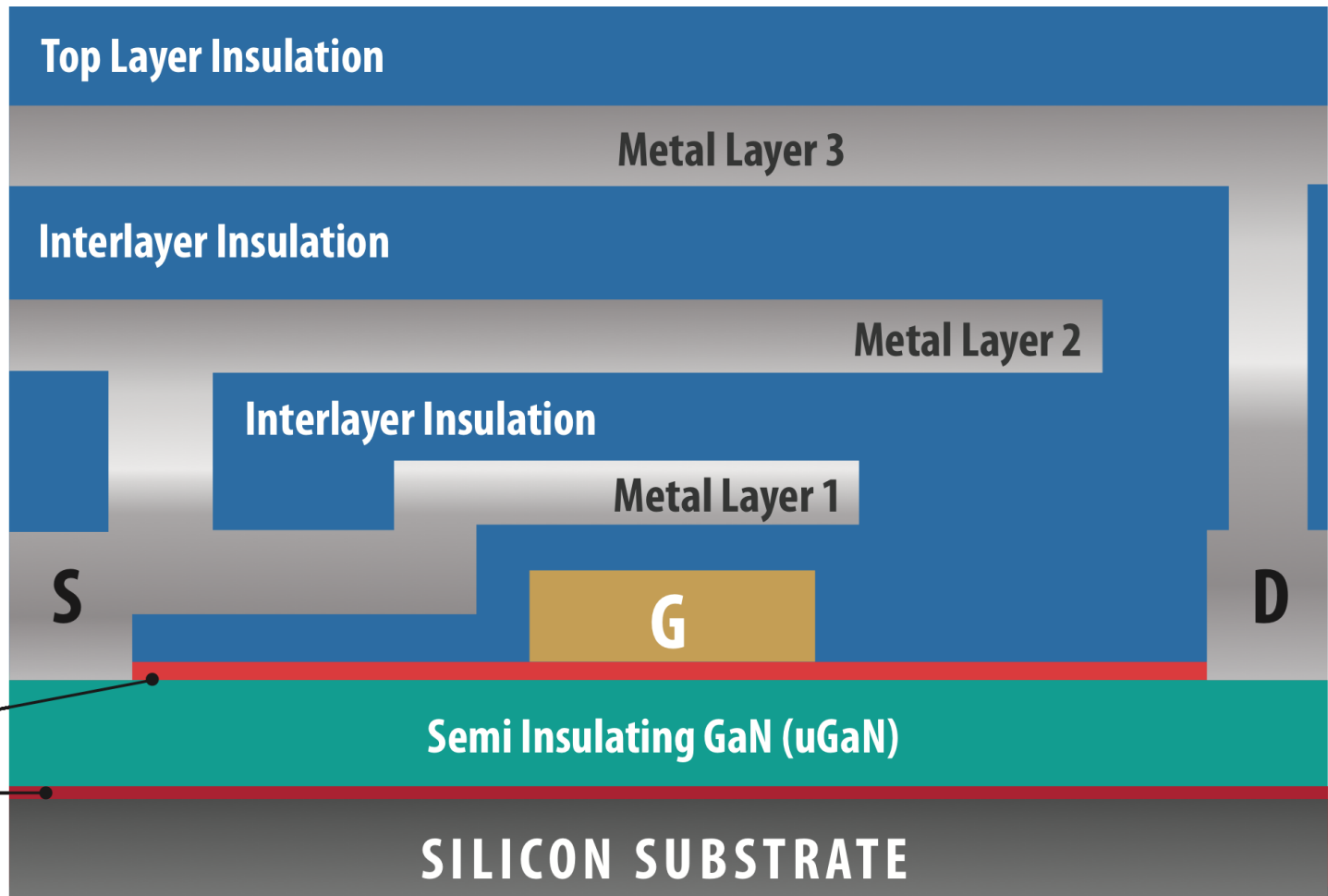
- **Overview of EPC *eGaN*<sup>®</sup> FET technology**
- **The opportunity to improve efficiency and performance**
- **Future Products**
- **Conclusions**

# Overview of eGaN FET Technology

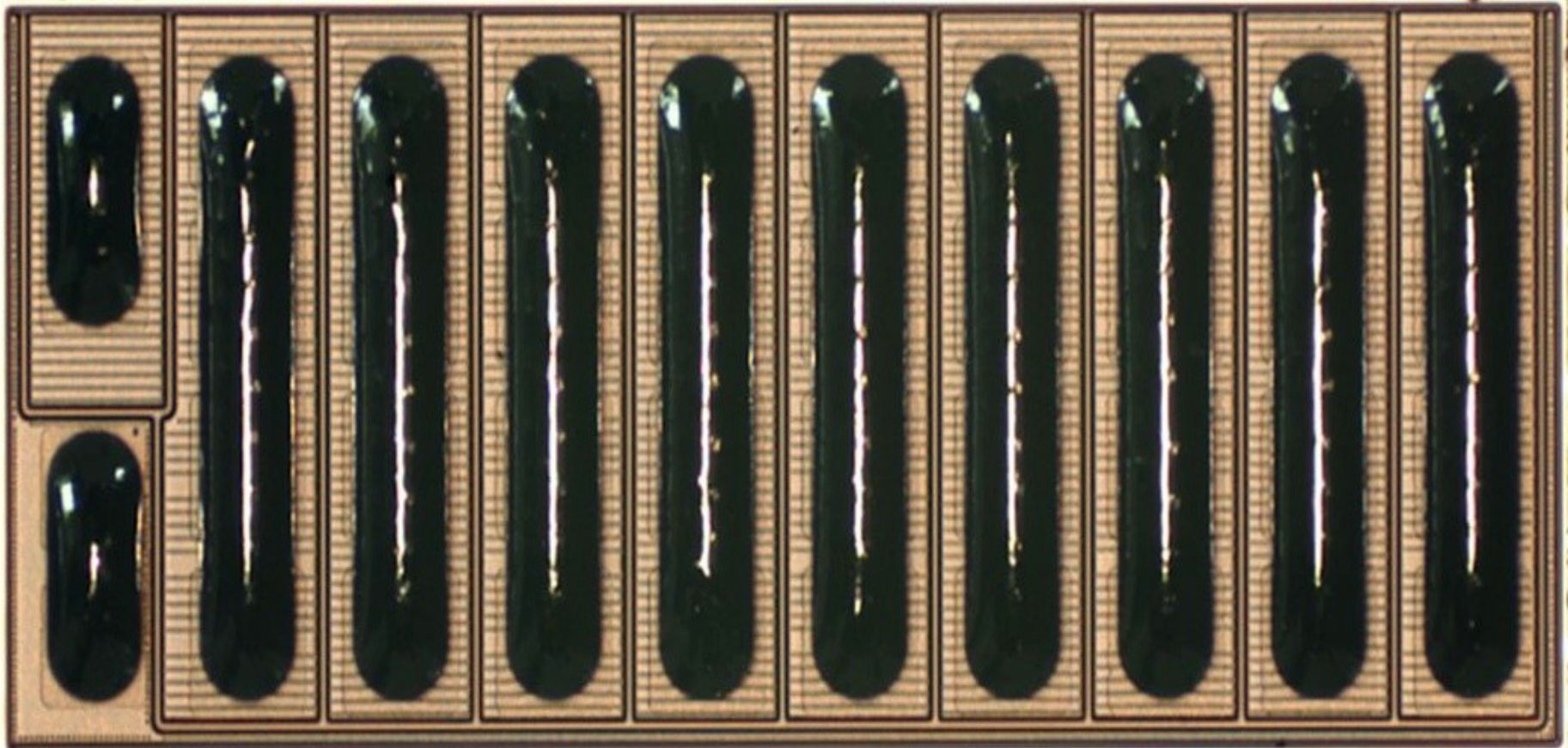
# eGaN FET Structure



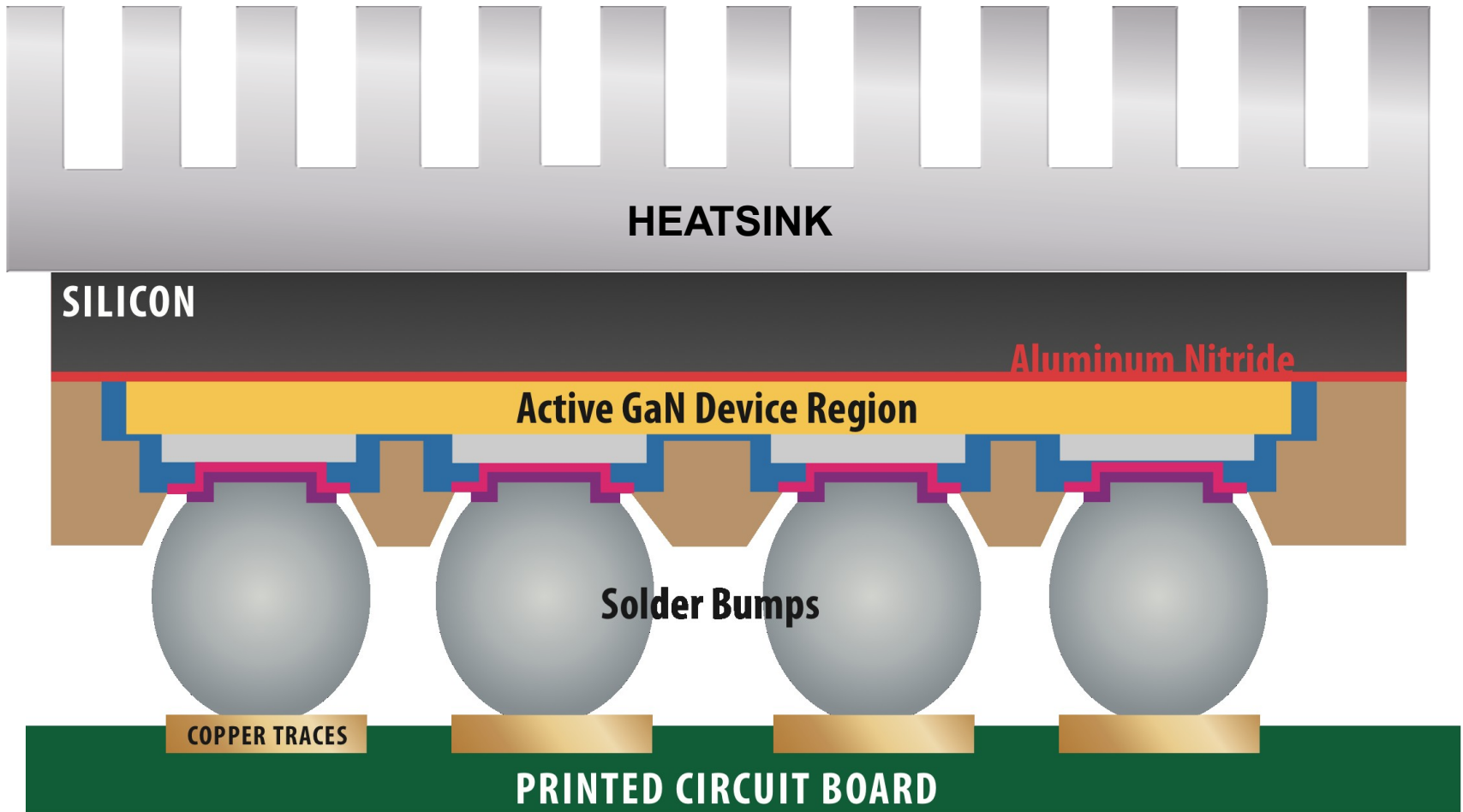
# eGaN FET Structure



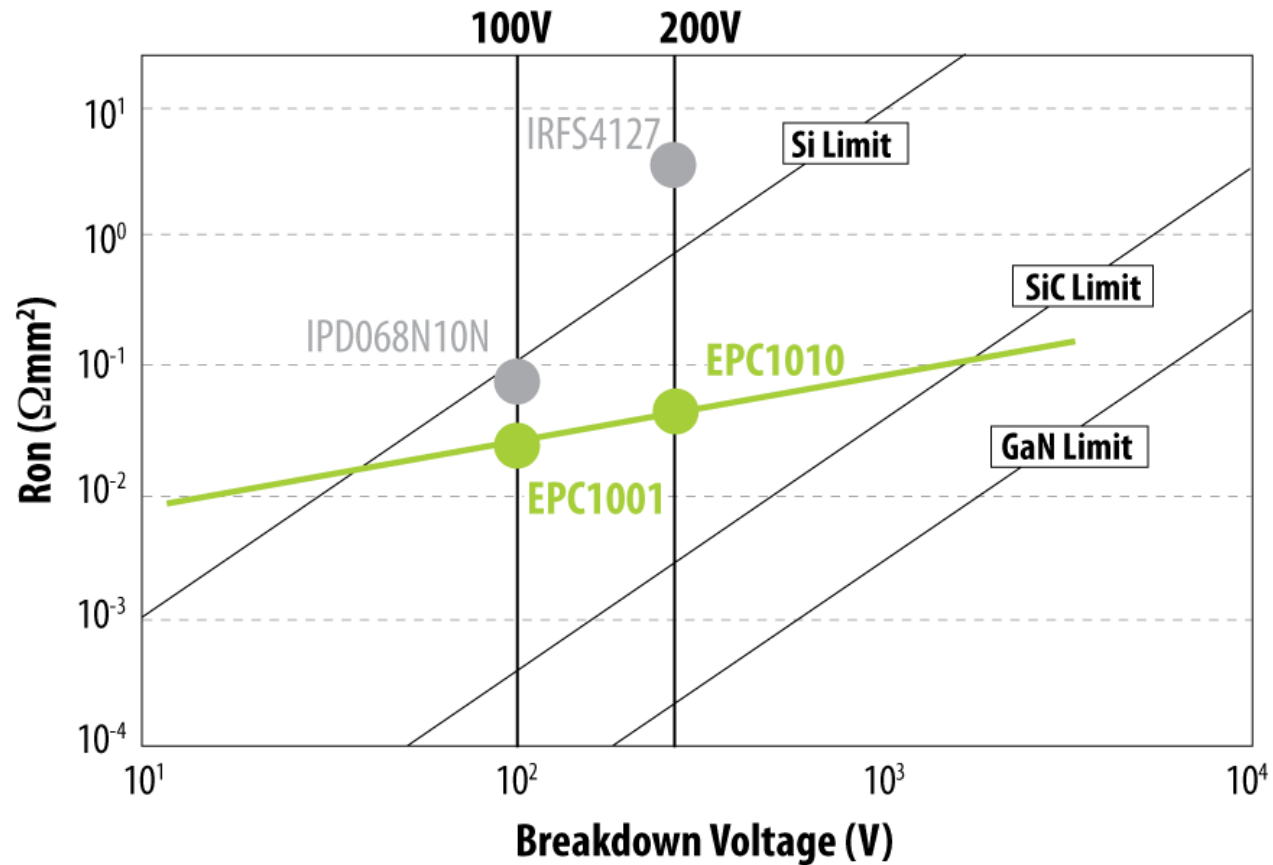
# eGaN FET Line Grid Array “Package”



# Flip Chip Assembly

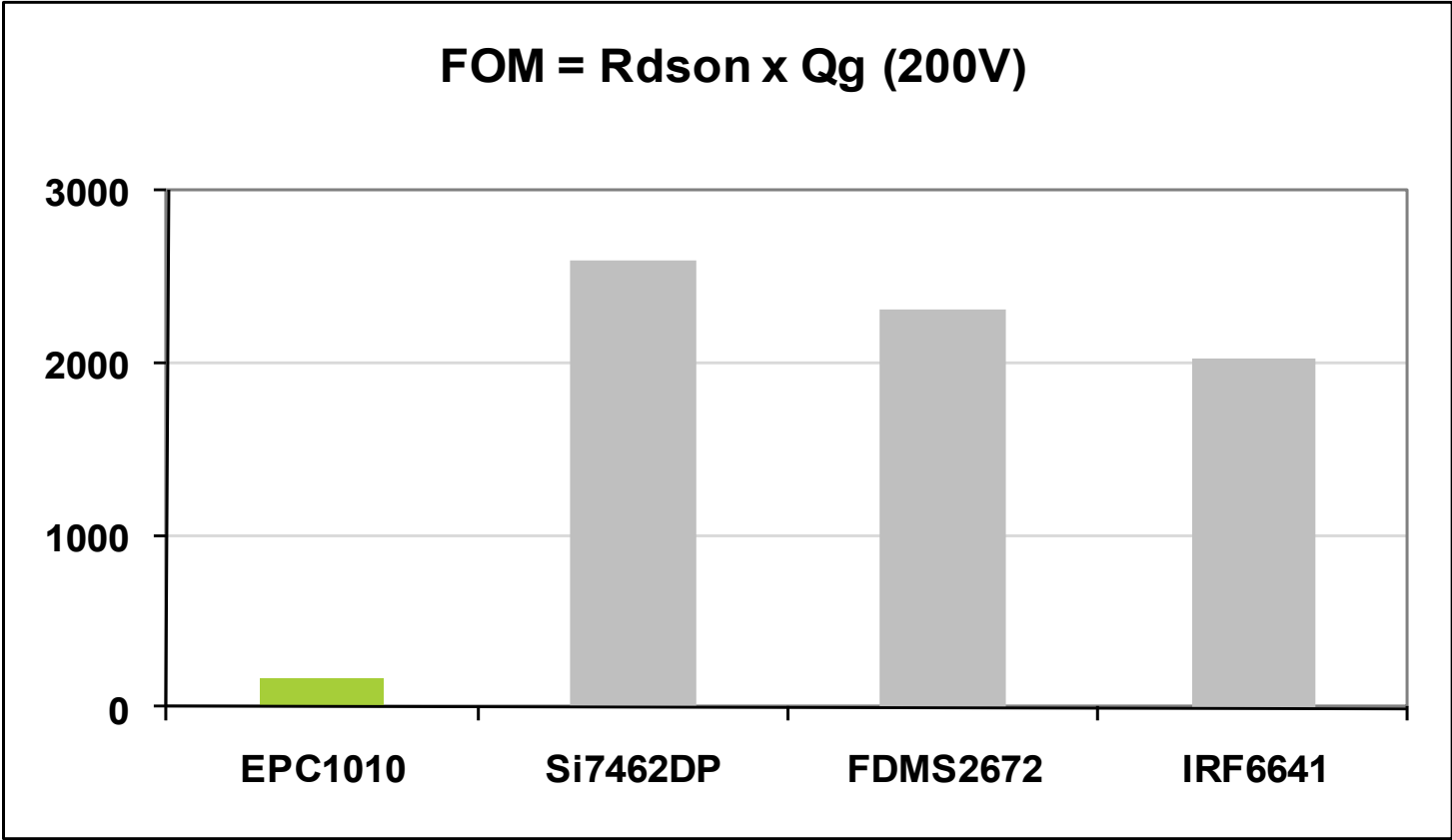


# GaN vs Si and SiC



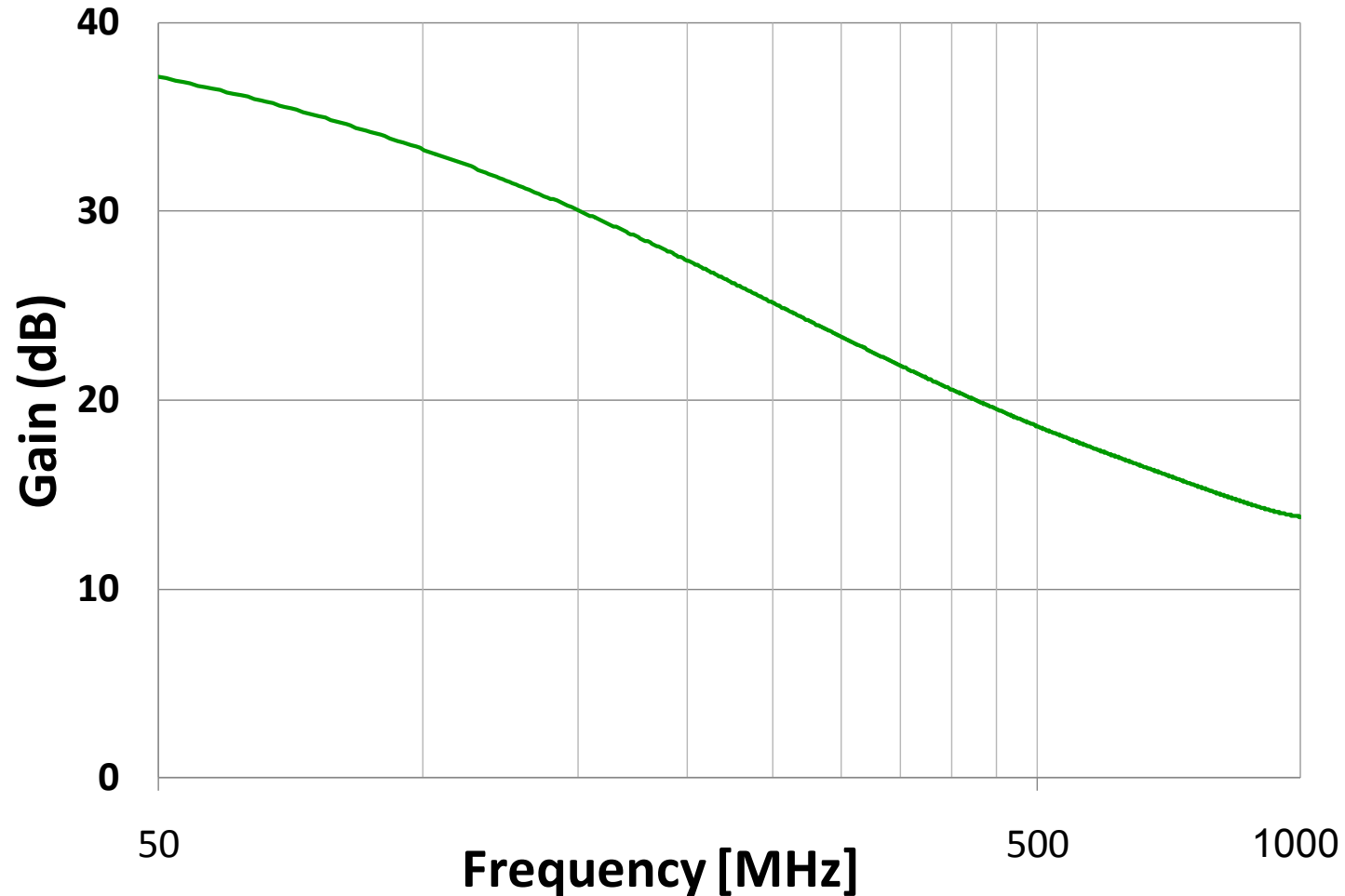


# eGaN Figure of Merit

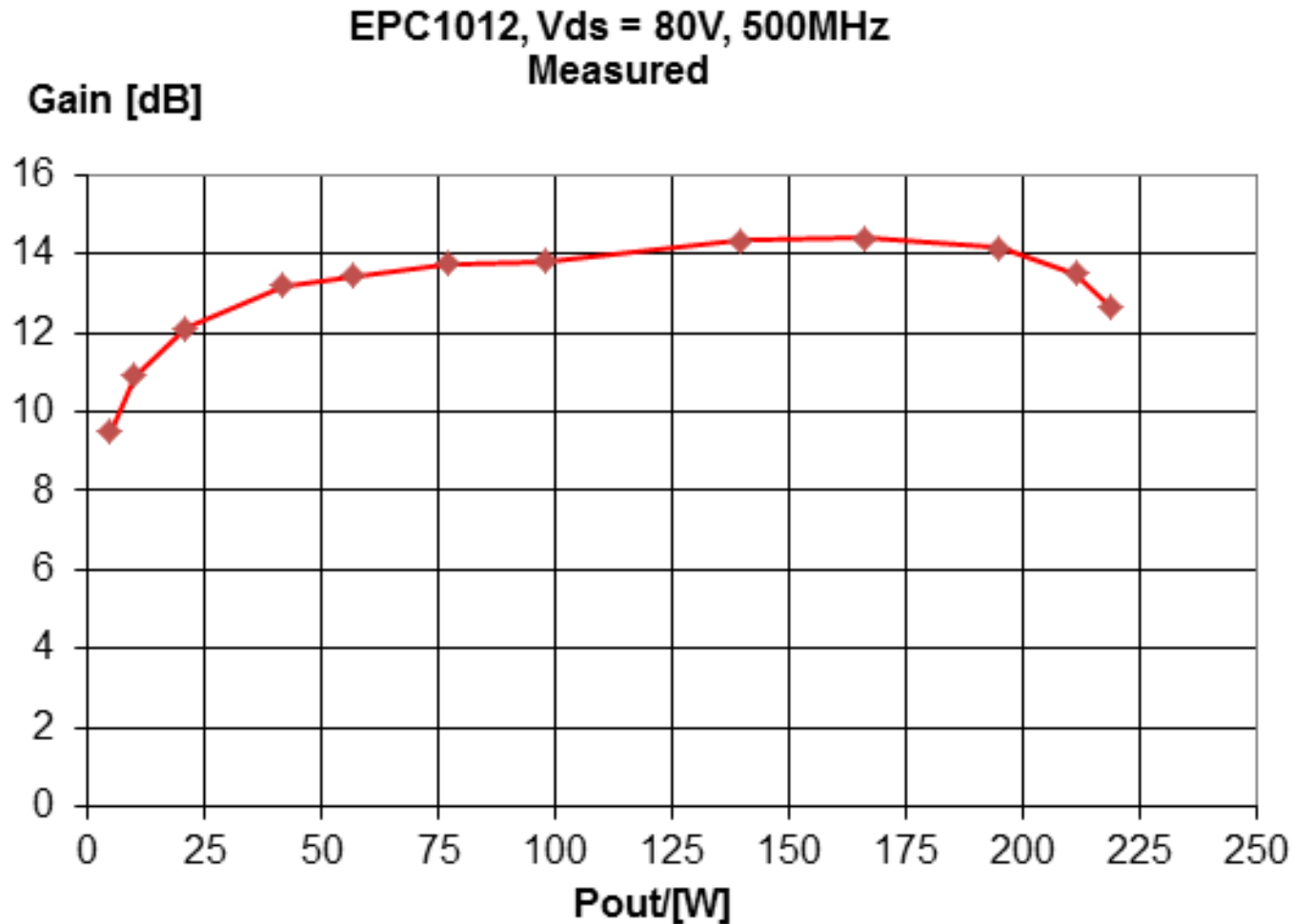


# High Frequency Capabilities

## EPC1012 Maximum Gain Vs Frequency



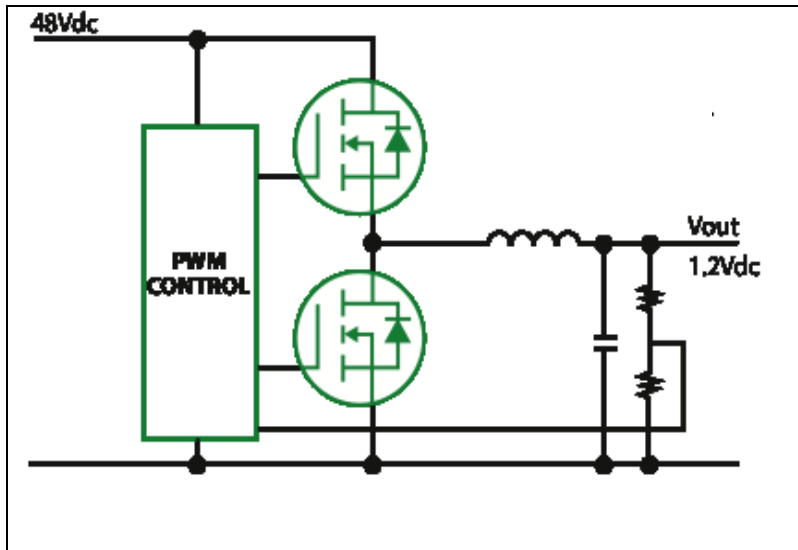
# High Frequency Capabilities



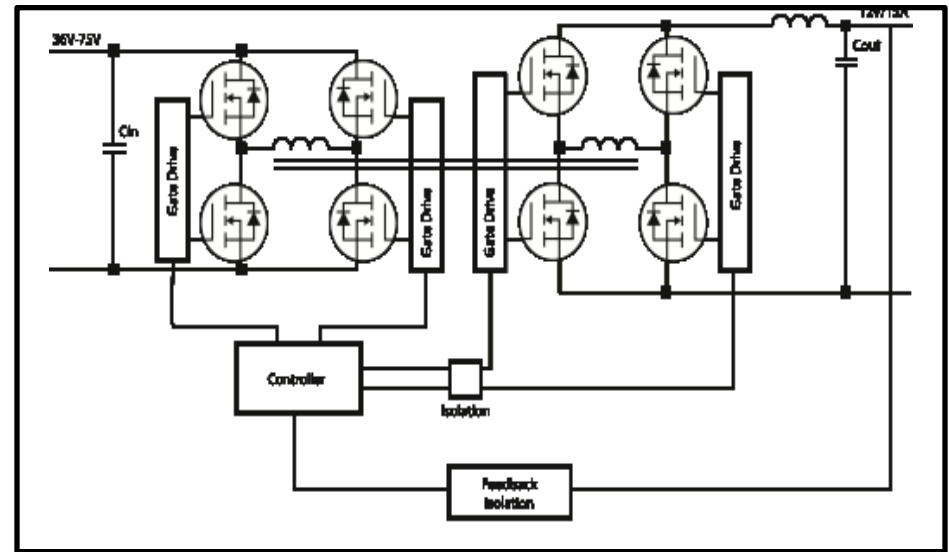
# The Opportunity to Improve DC-DC Efficiency

# Topologies Explored

## Buck Converter



## Full Bridge Isolated Converter



# Buck Converter

## Advantage:

- High power density and high efficiency

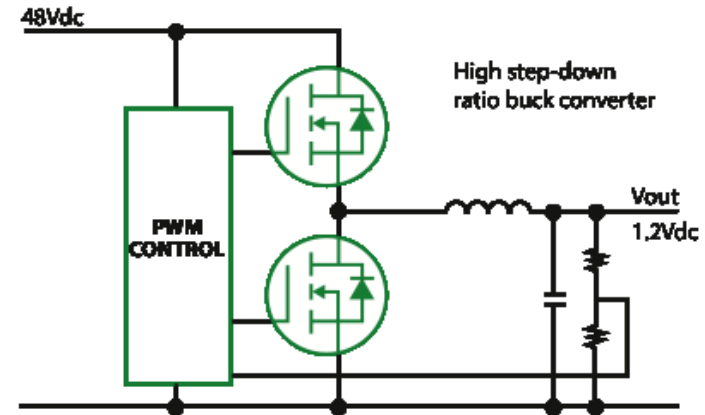
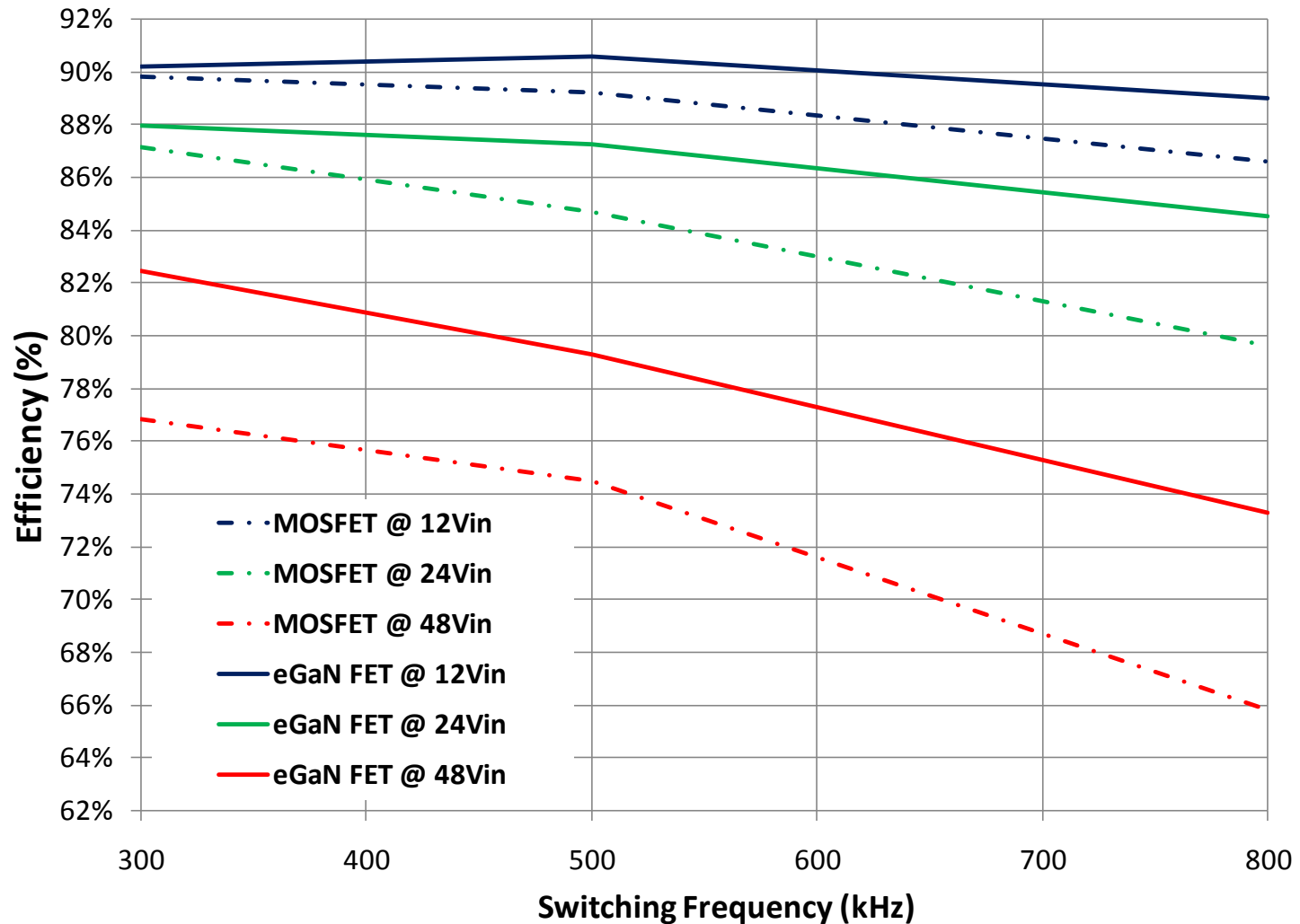


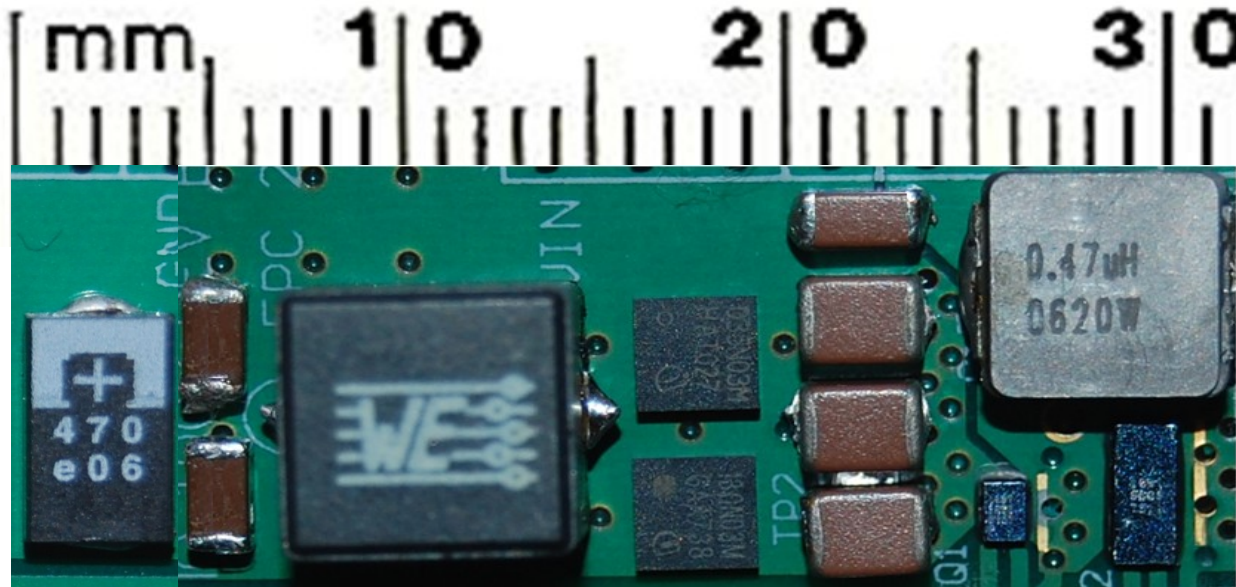
Figure 7 – Buck converter with an input voltage of 48 VDC and output voltage of 1.2 VDC

# Efficiency vs Frequency

1.2 Vout / 5A



# Buck Size Comparison



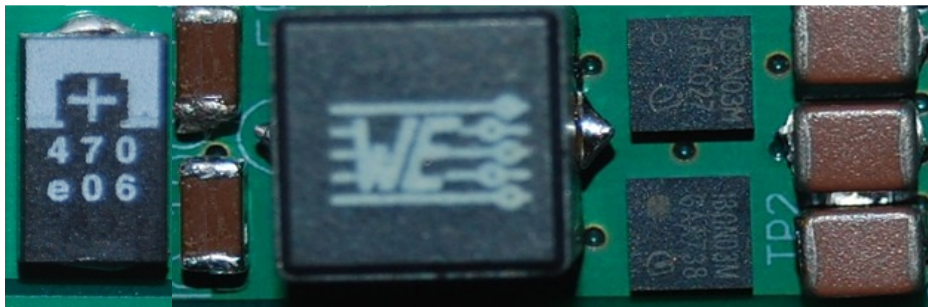
A 24V-1.2V Buck converter was built with both with eGaN FETs and state-of-the-art silicon power MOSFETs



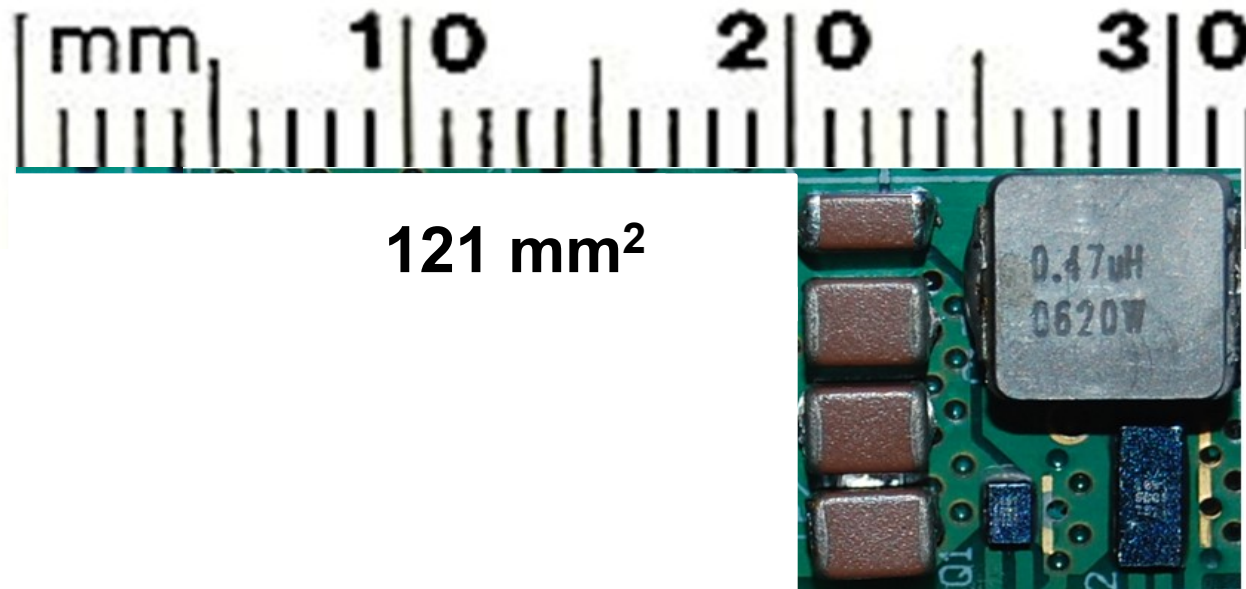
# Buck Size Comparison



**184 mm<sup>2</sup>**



# Buck Size Comparison

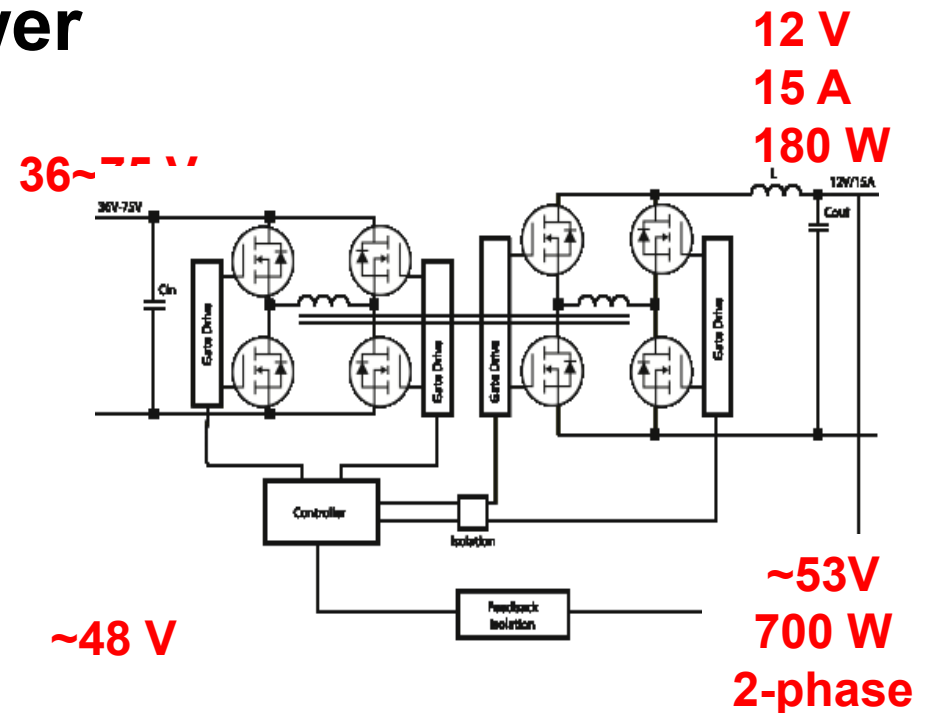


A 24V-1.2V Buck converter with eGaN FETs is 50% smaller and has 30% less power losses at 800 kHz.

# Isolated Full Bridge Converter

## Advantage:

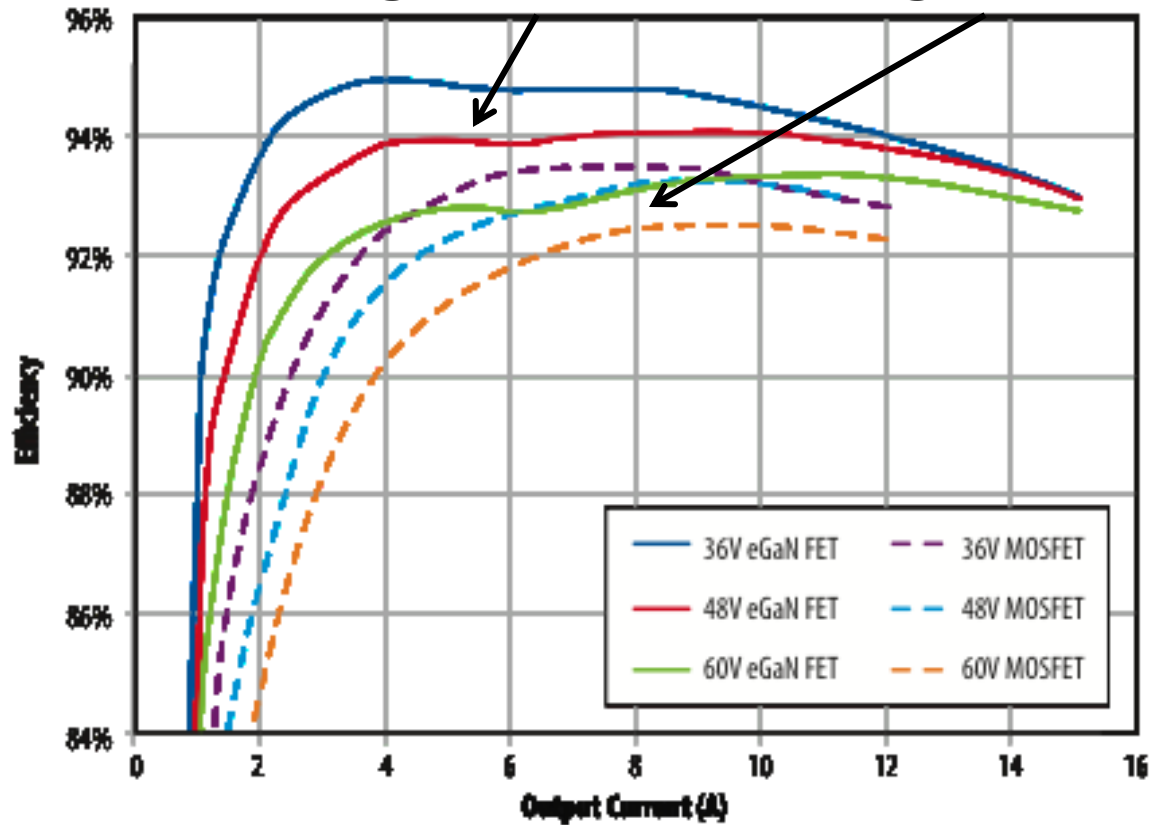
- Isolation and high power density at high power



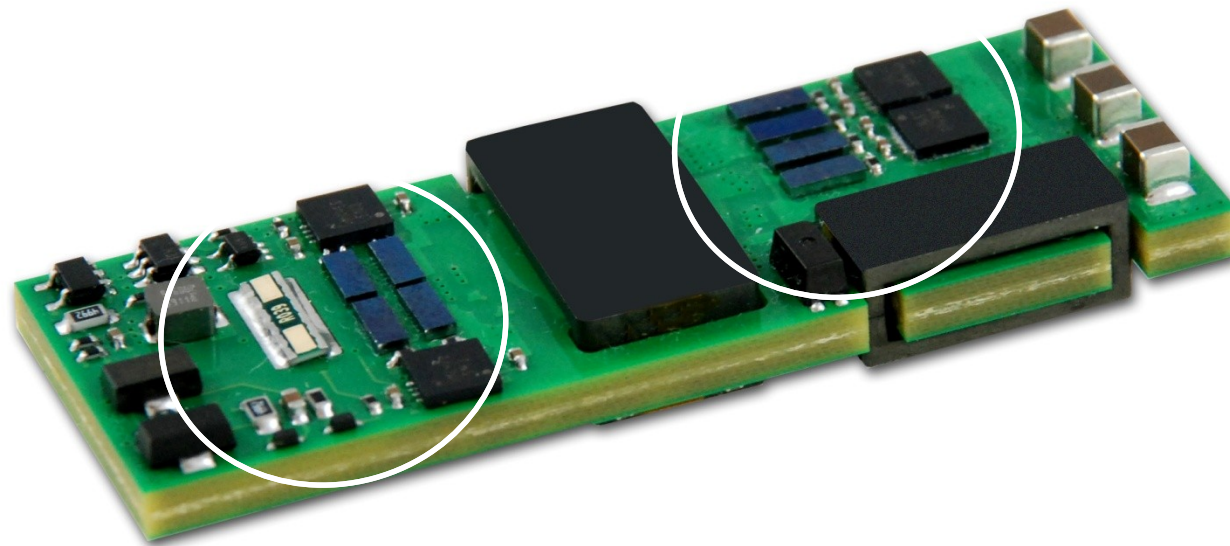
# Isolated Full Bridge Converter

Efficiency comparison @ 12 V<sub>OUT</sub>

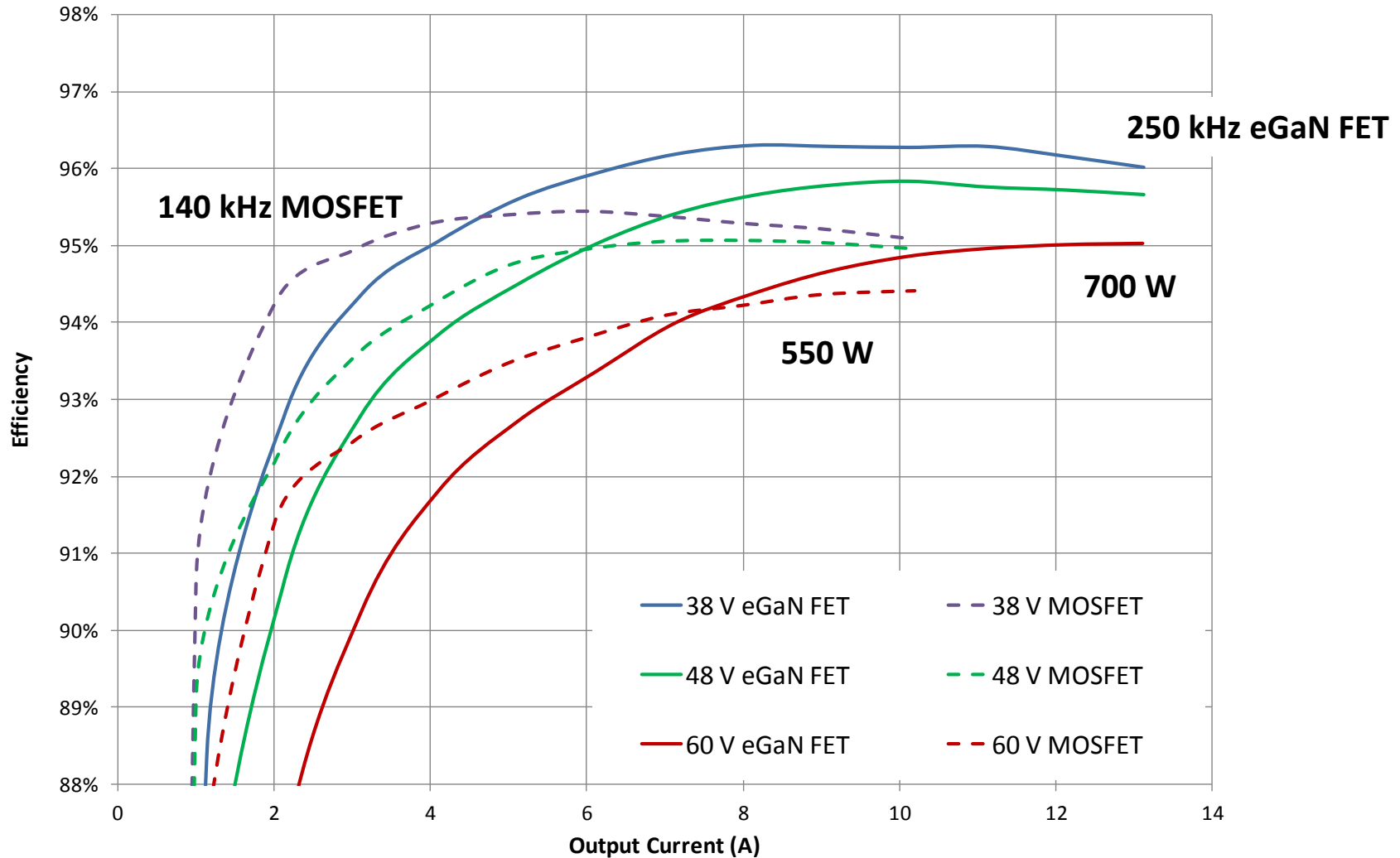
eGaN FET @ 333 kHz vs MOSFET @ 250 kHz



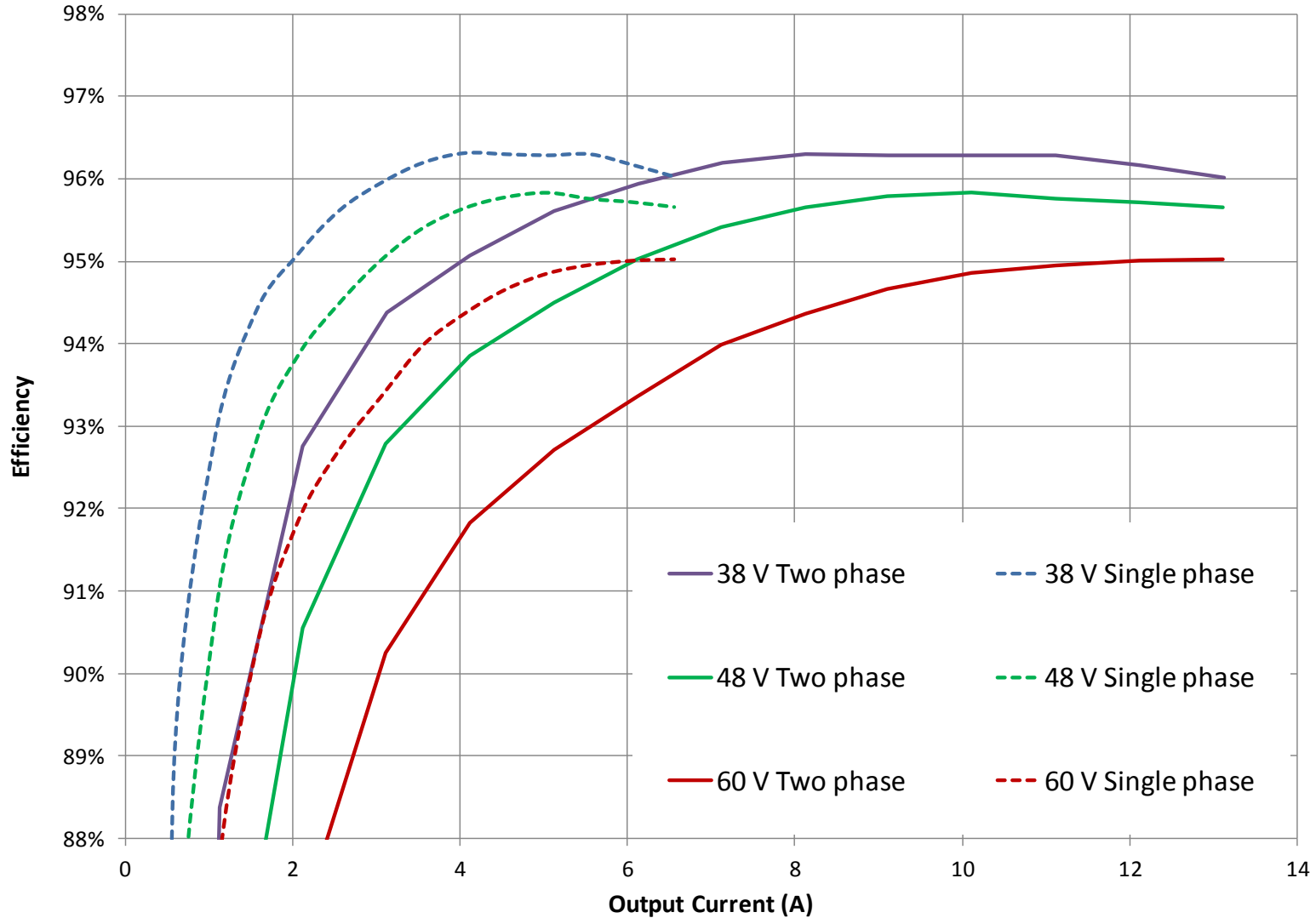
# Isolated Full Bridge Converter



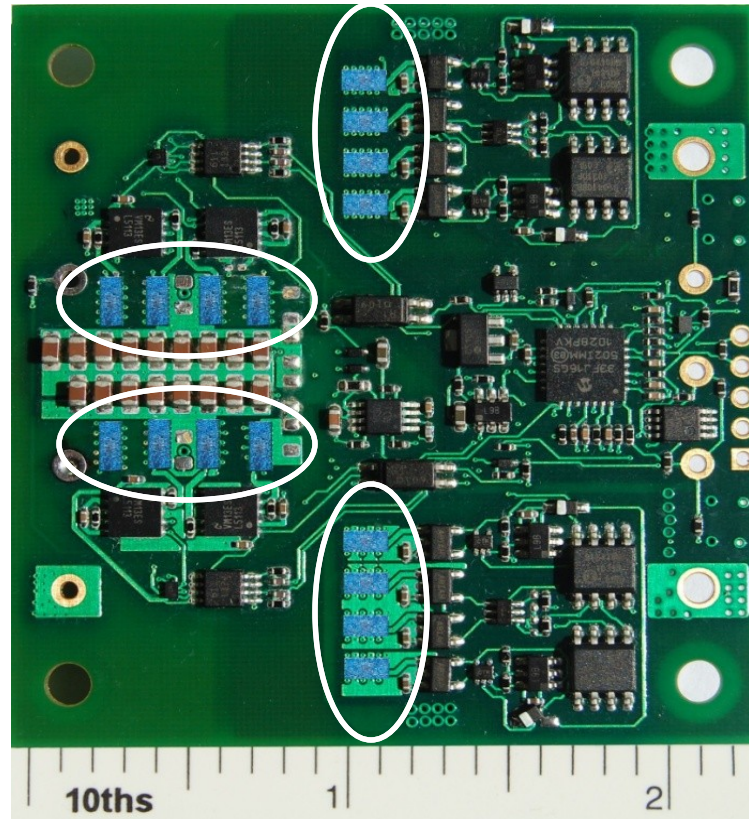
# PoE-PSE Full Bridge Converter



# PoE-PSE Full Bridge Converter

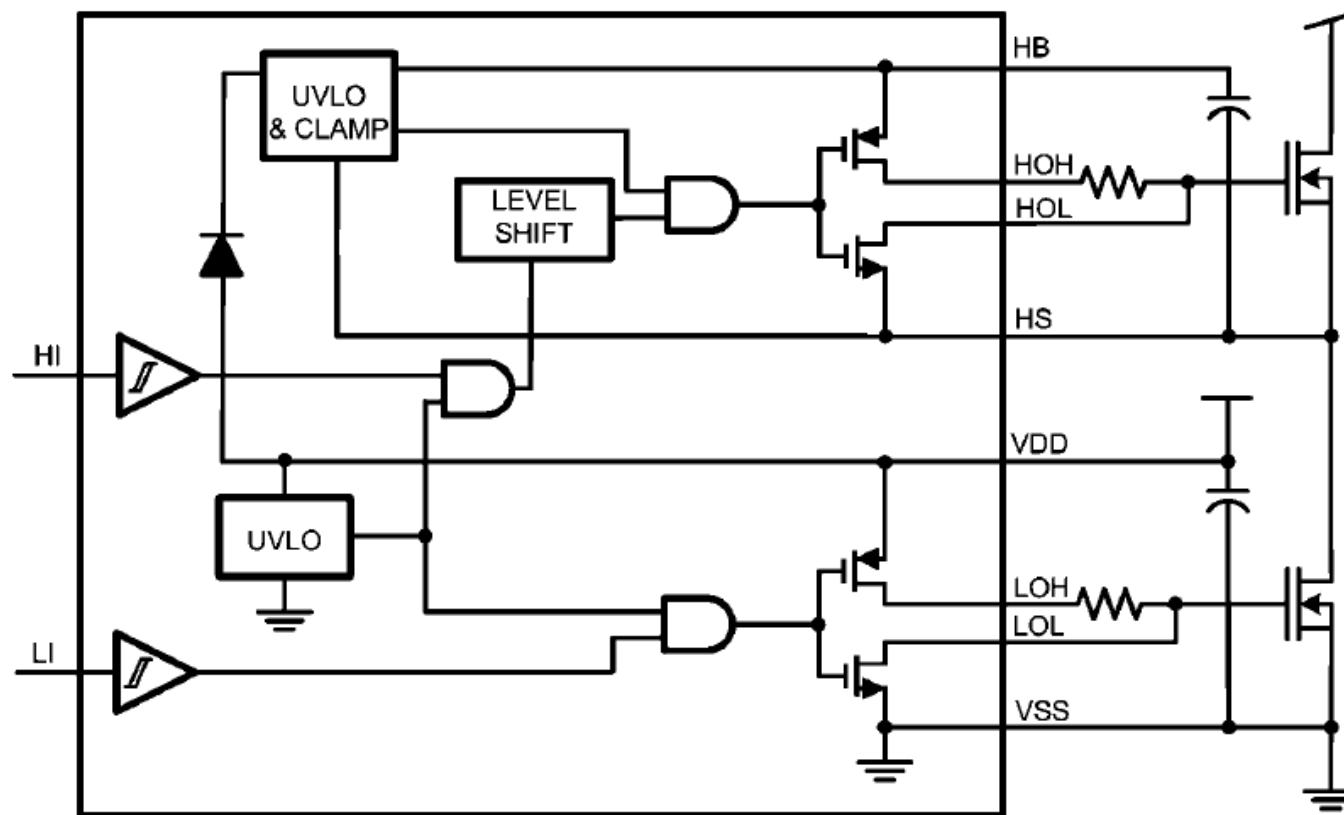


# PoE-PSE Full Bridge Converter





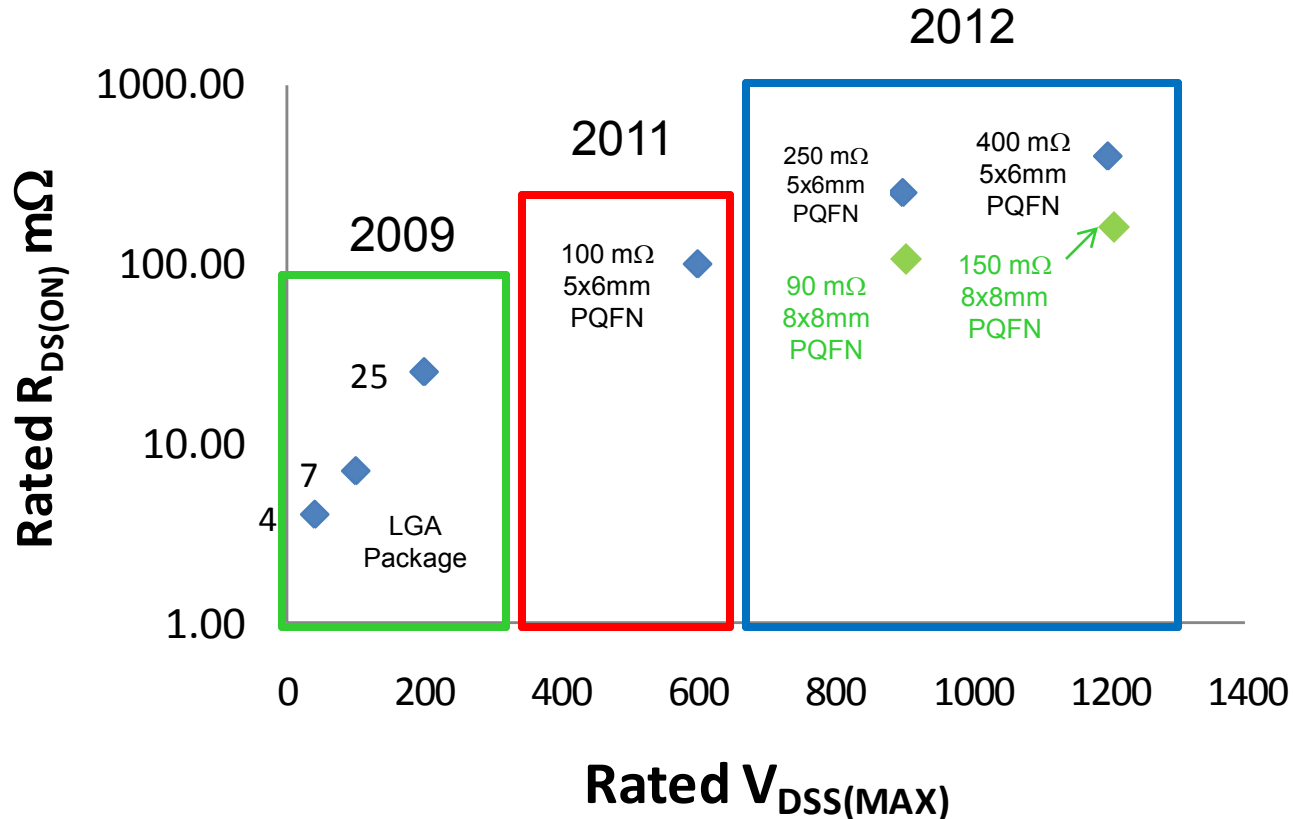
# Integrated Gate Driver Solution



**LM5113 from National Semiconductor**

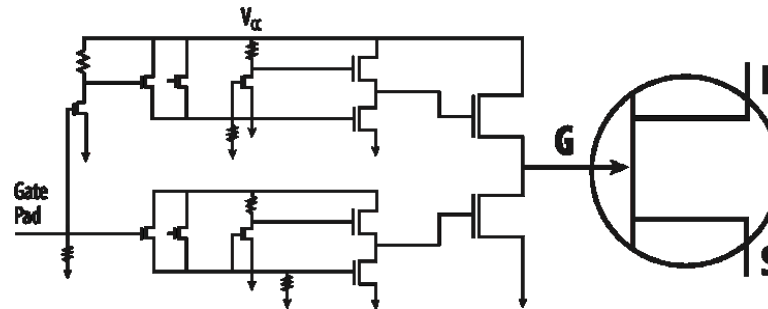
# EPC Product Plans

# Beyond 600 Volts

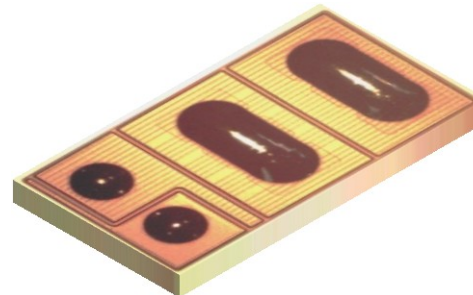


EPC's eGaN FET products will extend to 600V in 2011 and to 900V and 1200V in 2012 if there is adequate customer interest

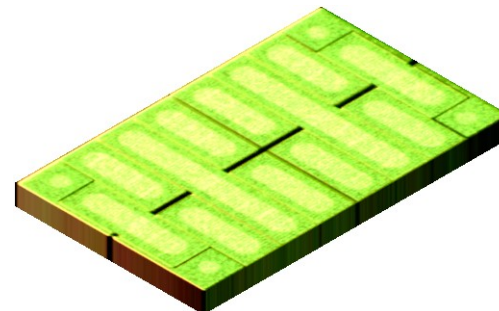
## *Driver On Board*



## Discrete FET with Driver



## Full-Bridge with Driver and Level Shift



- **eGaN<sup>®</sup> technology opens up options for improving overall system efficiency.**
- **eGaN FETs demonstrated significant performance improvement**
- **eGaN technology will enable even higher power density and cost reductions through higher levels of integration.**



*The end of the road  
for silicon.....*

*is the beginning of  
the eGaN FET  
journey!*