Darnell Power Forum 2012

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Efficient Power Conversion Corporation

Agenda

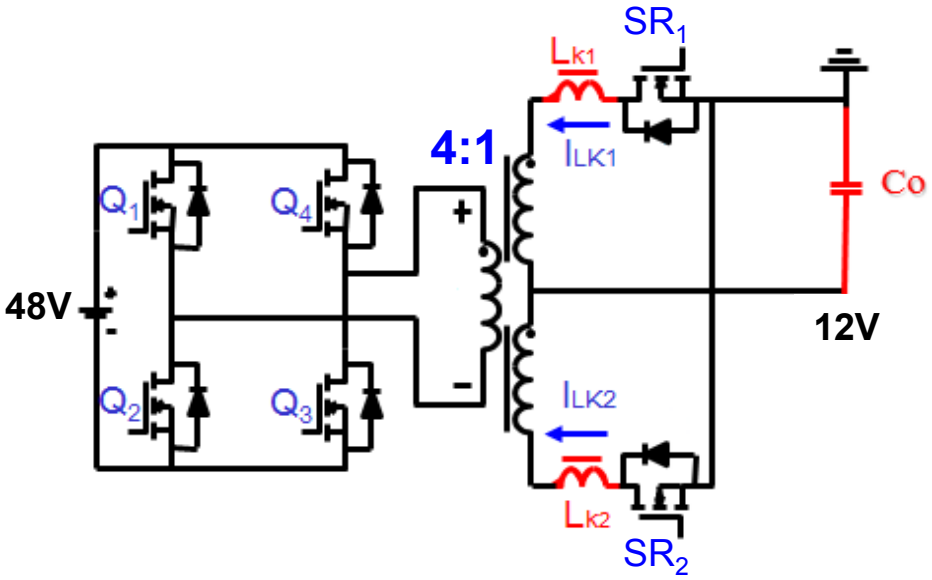
- Where are we now?
- High Frequency Resonant Converters
- Wireless Power
- Envelope Tracking
- Summary

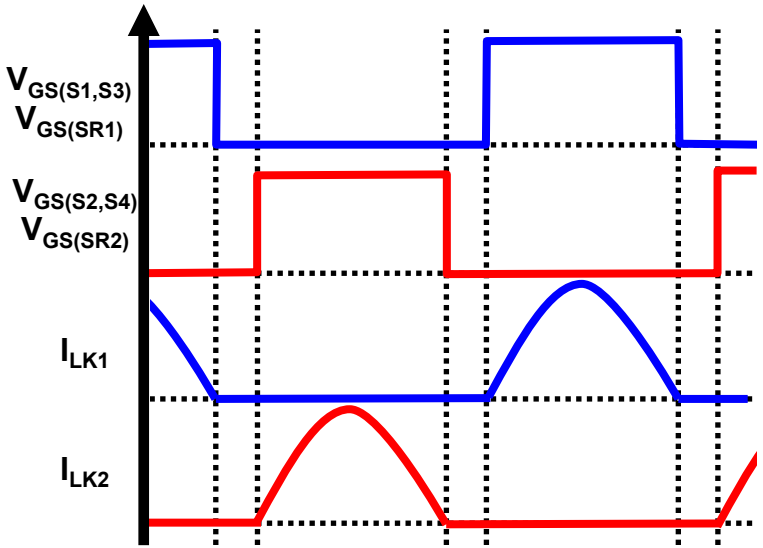
- ✓ Buck Converters
- ✓ Forward Converters
- ✓ Flyback Converters
- ✓ Full-Bridge Isolated Converters

- ➢ Resonant Converters
- ➢ Wireless Power
- ➢ High Frequency Buck Converters for Envelope Tracking

Resonant Converters

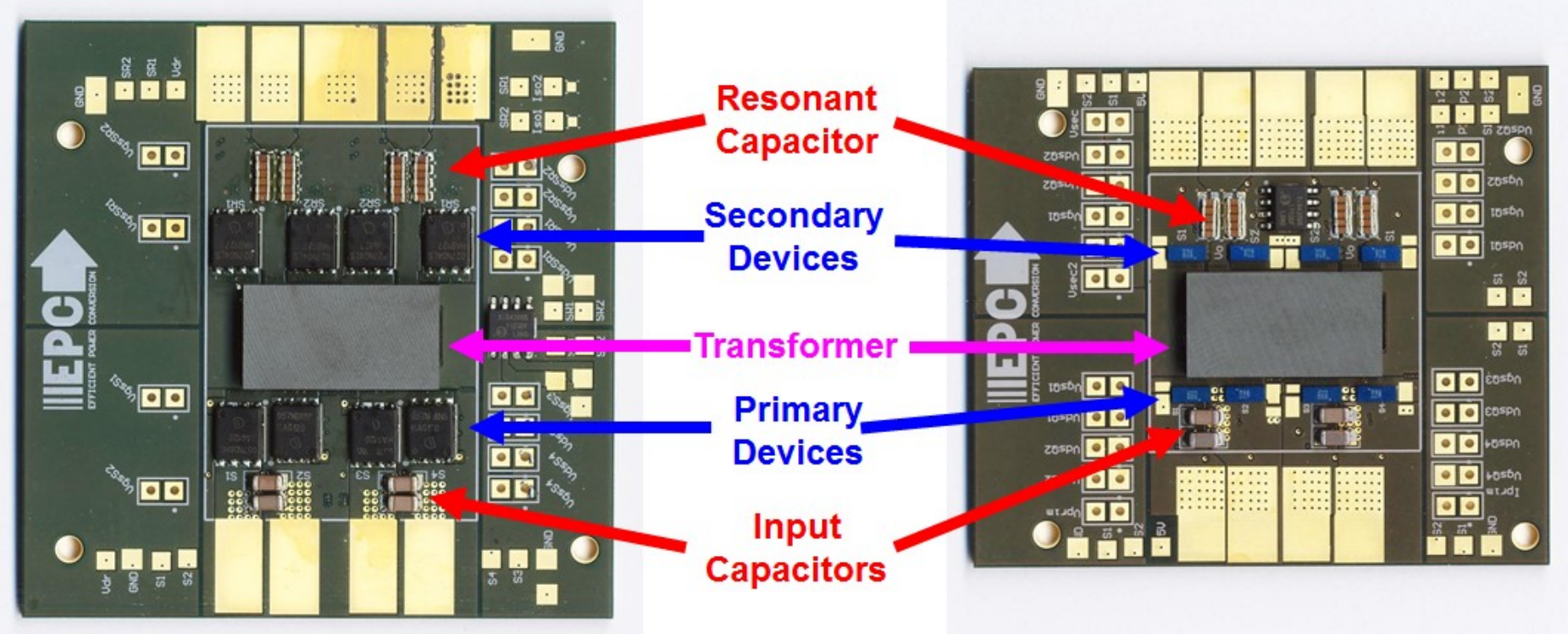
Resonant Converter



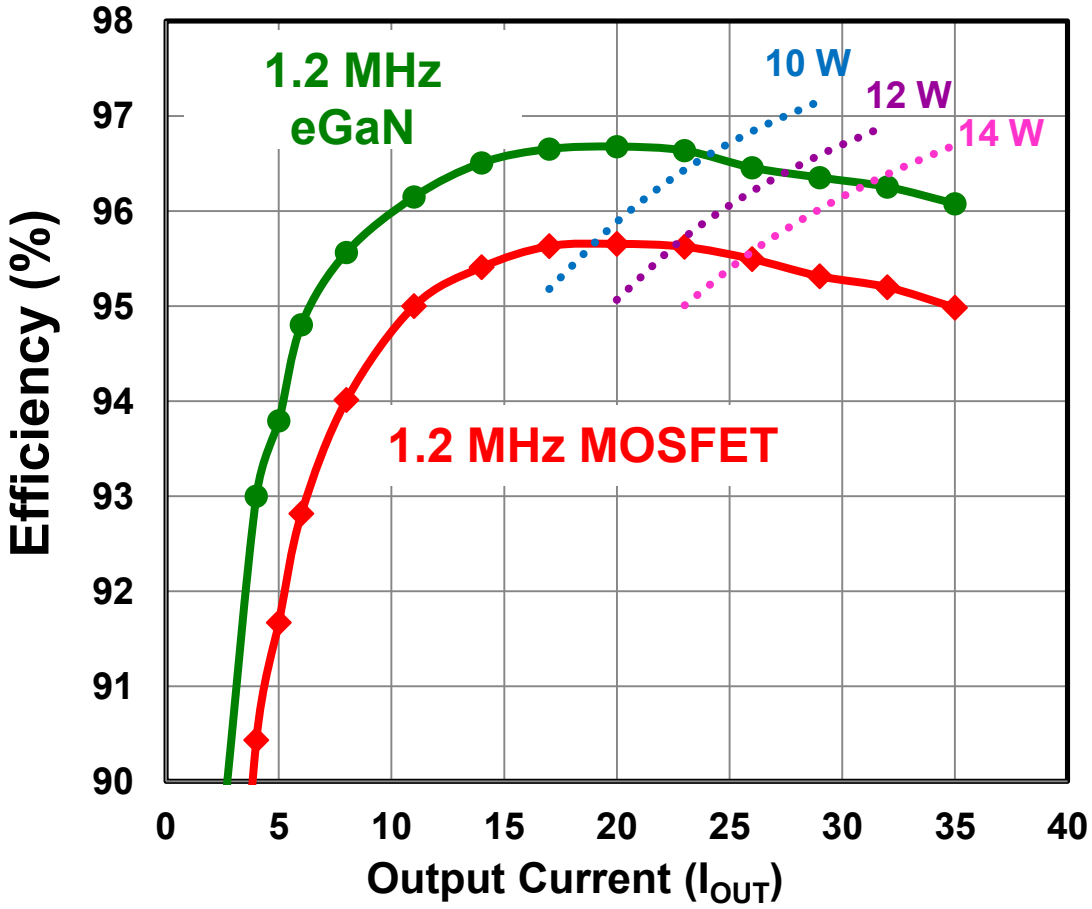


Ref: Y. Ren, M. Xu, J. Sun, and F. C. Lee, "A family of high power density unregulated bus converters," IEEE Trans. Power Electron., vol. 20, no. 5, pp. 1045–1054, Sep. 2005.

eGaN® FET vs MOSFET

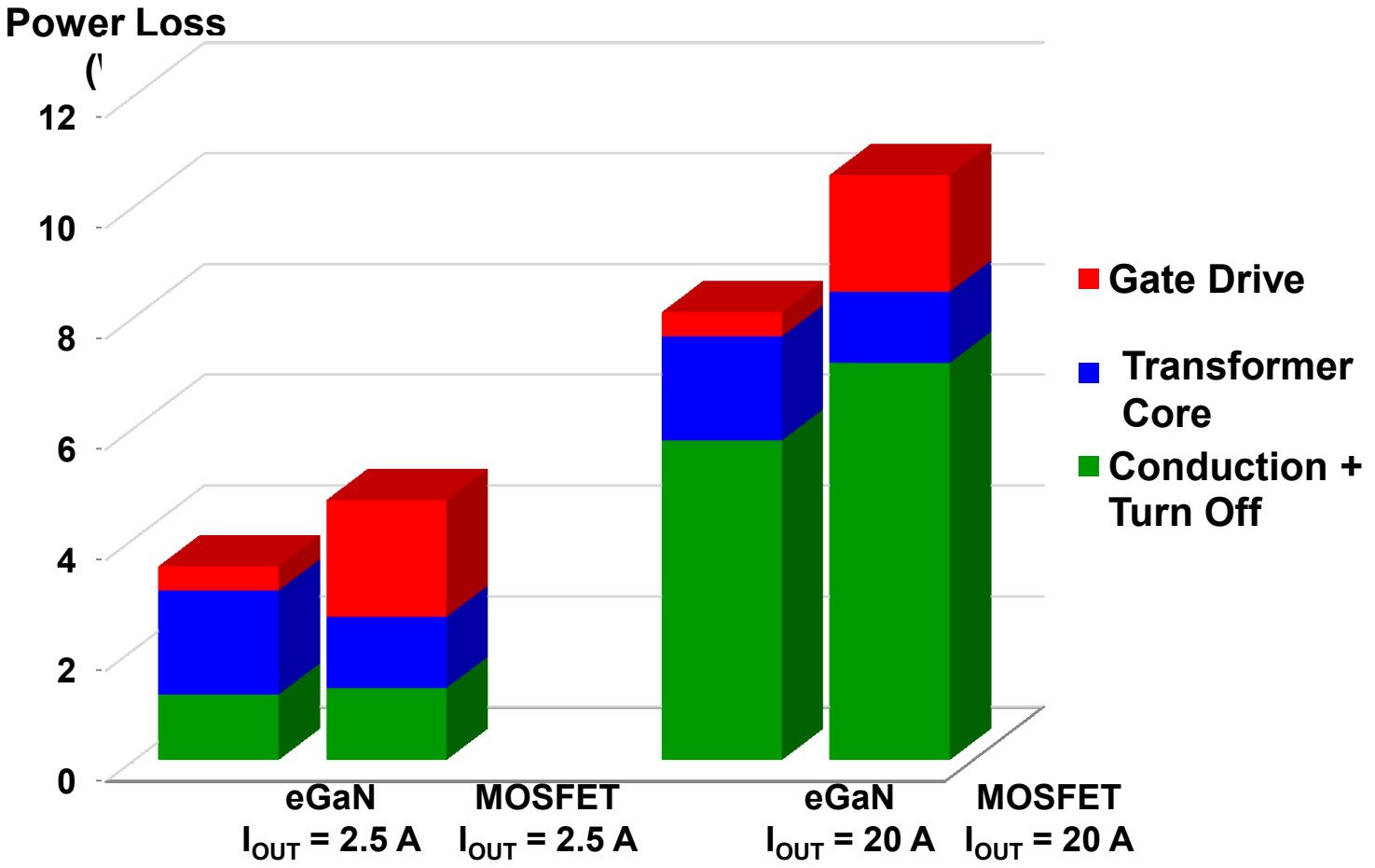


Efficiency Comparison



F_S = 1.2 MHz, V_{IN} = 48 V, and V_{OUT} = 12 V

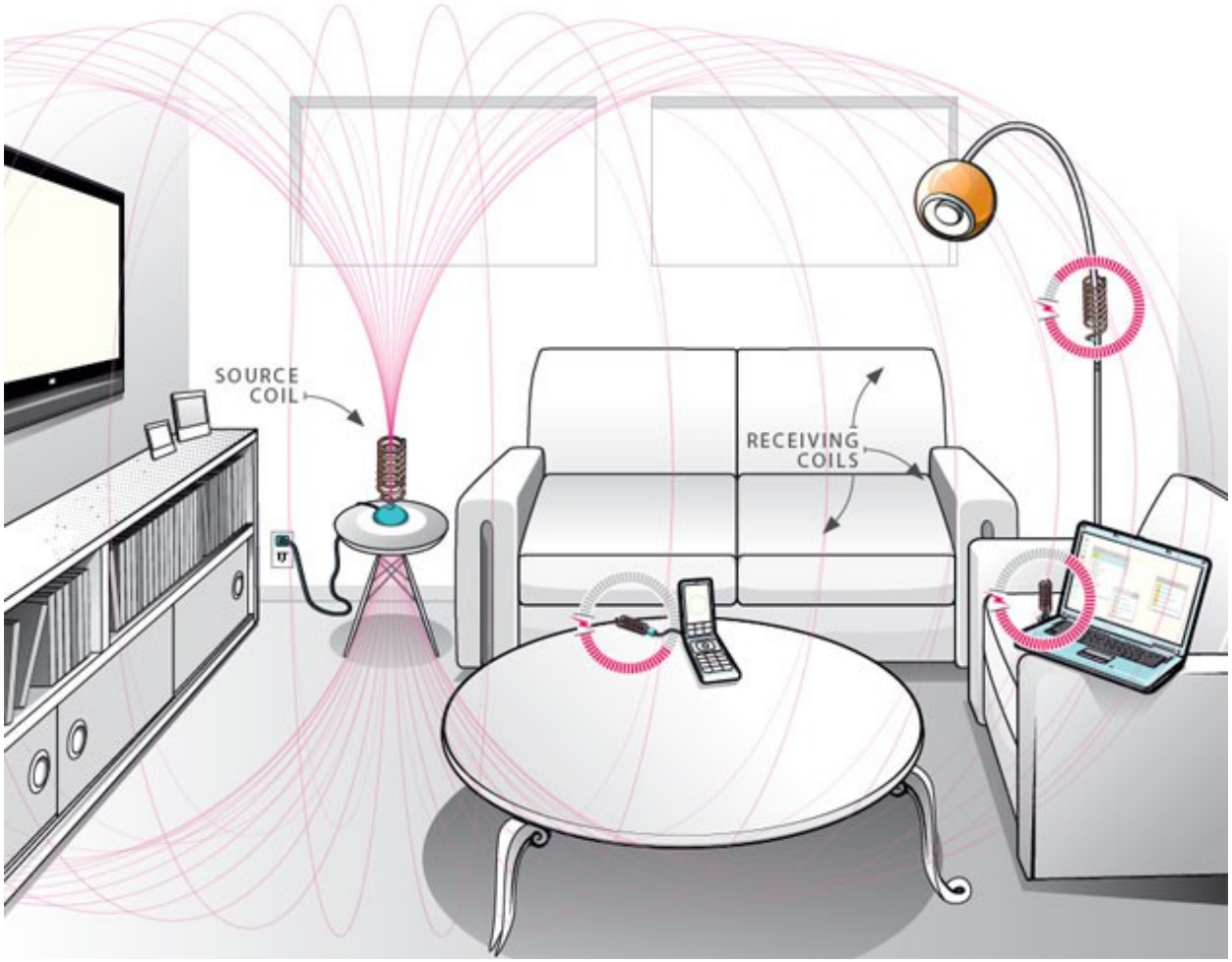
Loss Breakdown



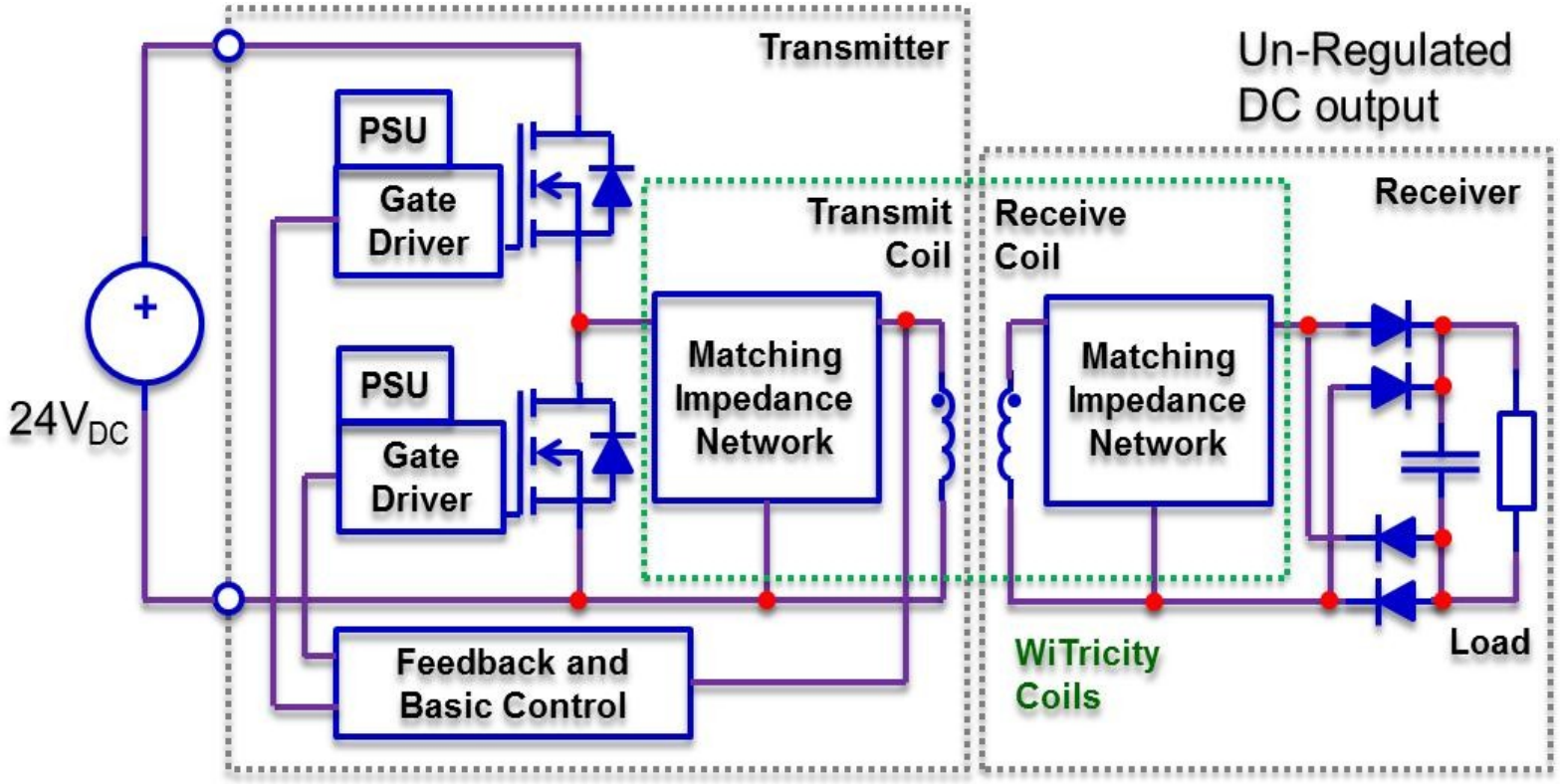
F_S = 1.2 MHz, V_{IN} = 48 V, and V_{OUT} = 12 V

Wireless Power

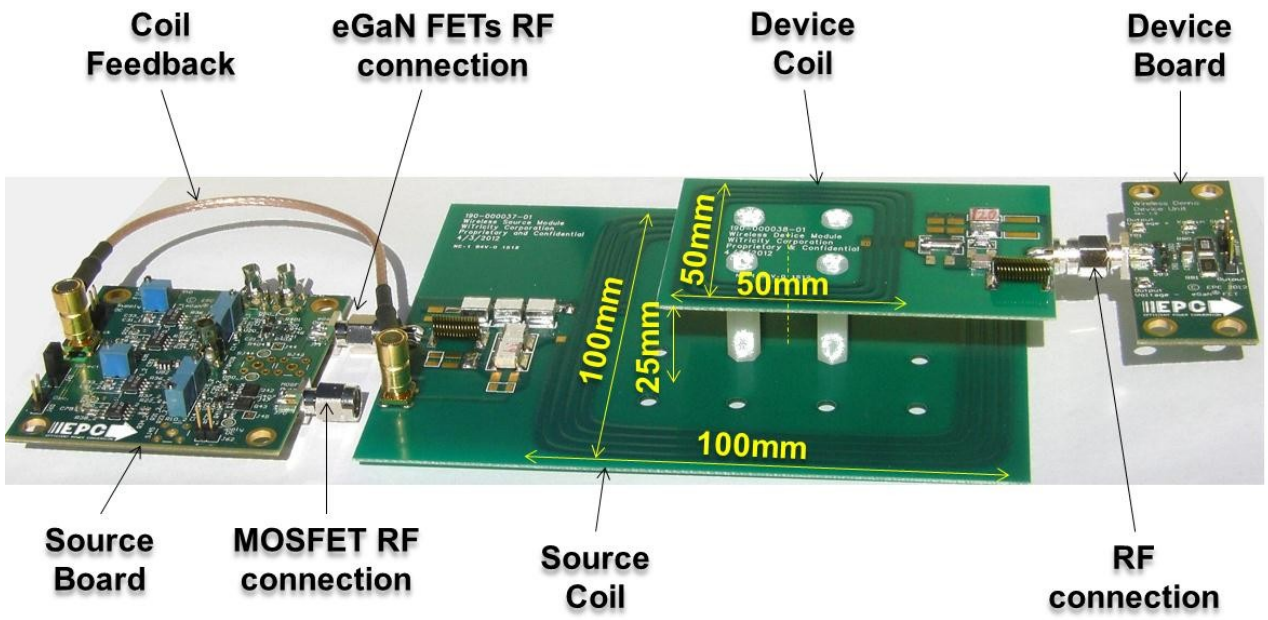
Wireless Power



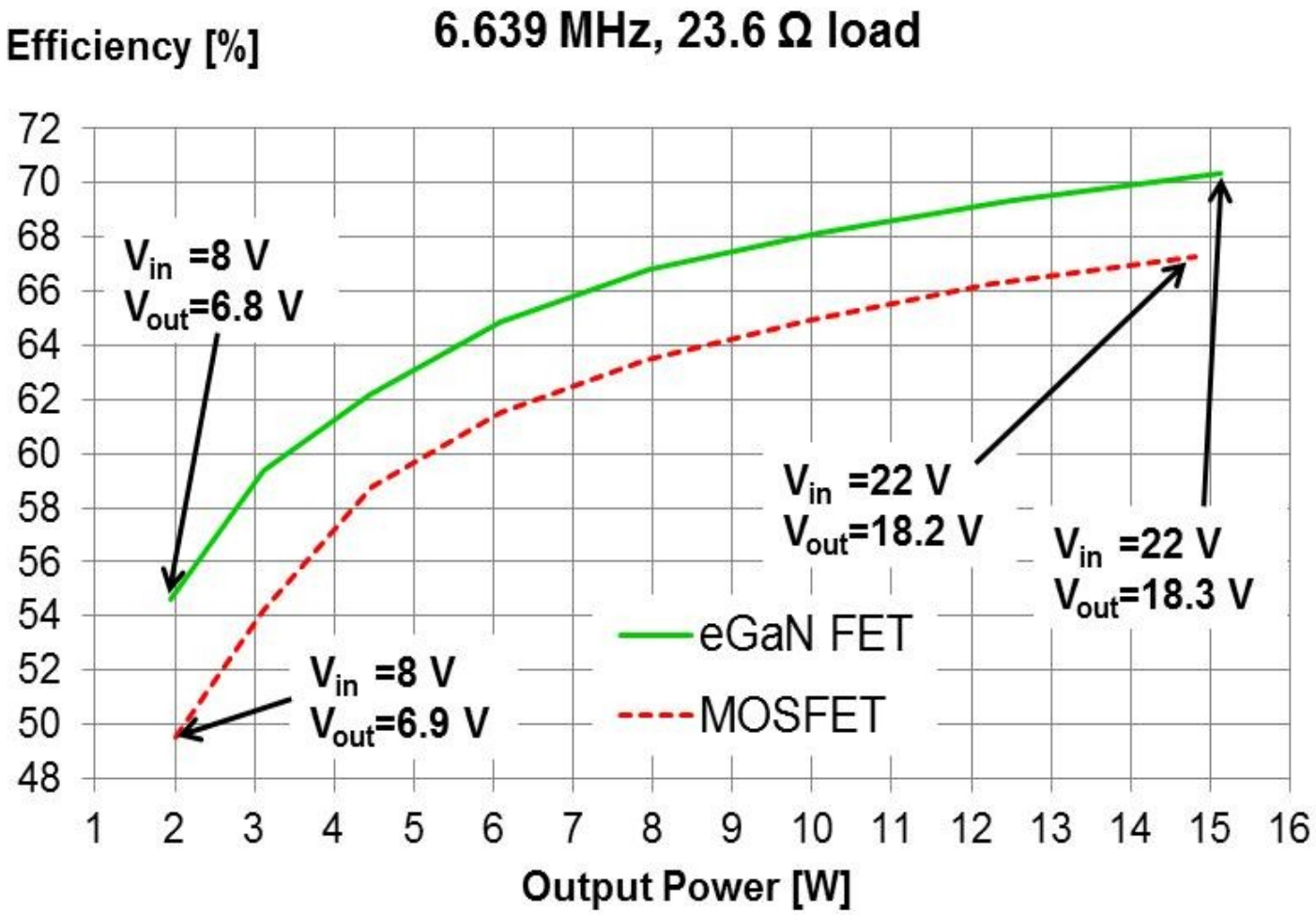
Wireless Power



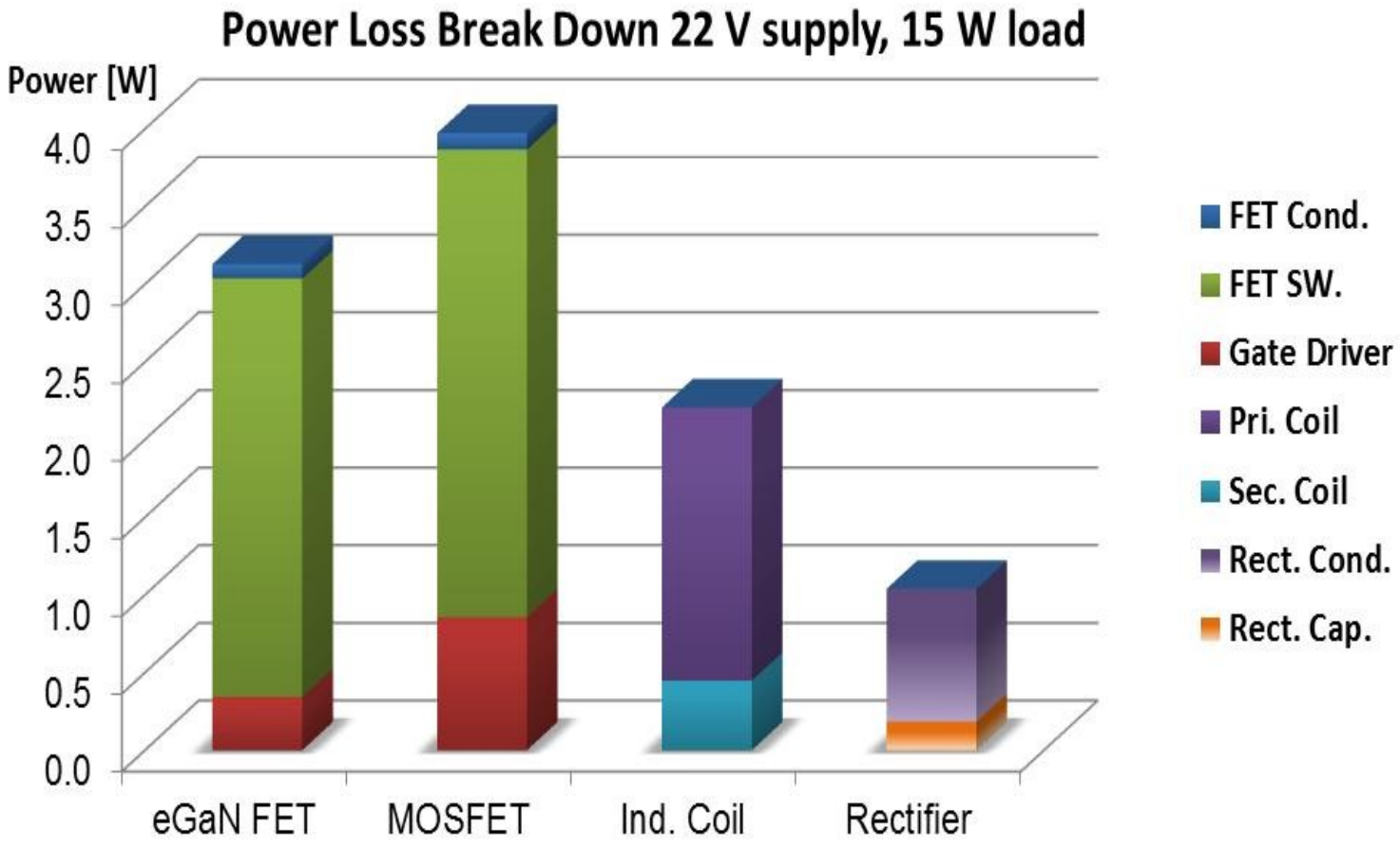
Wireless Power



Efficiency Comparison

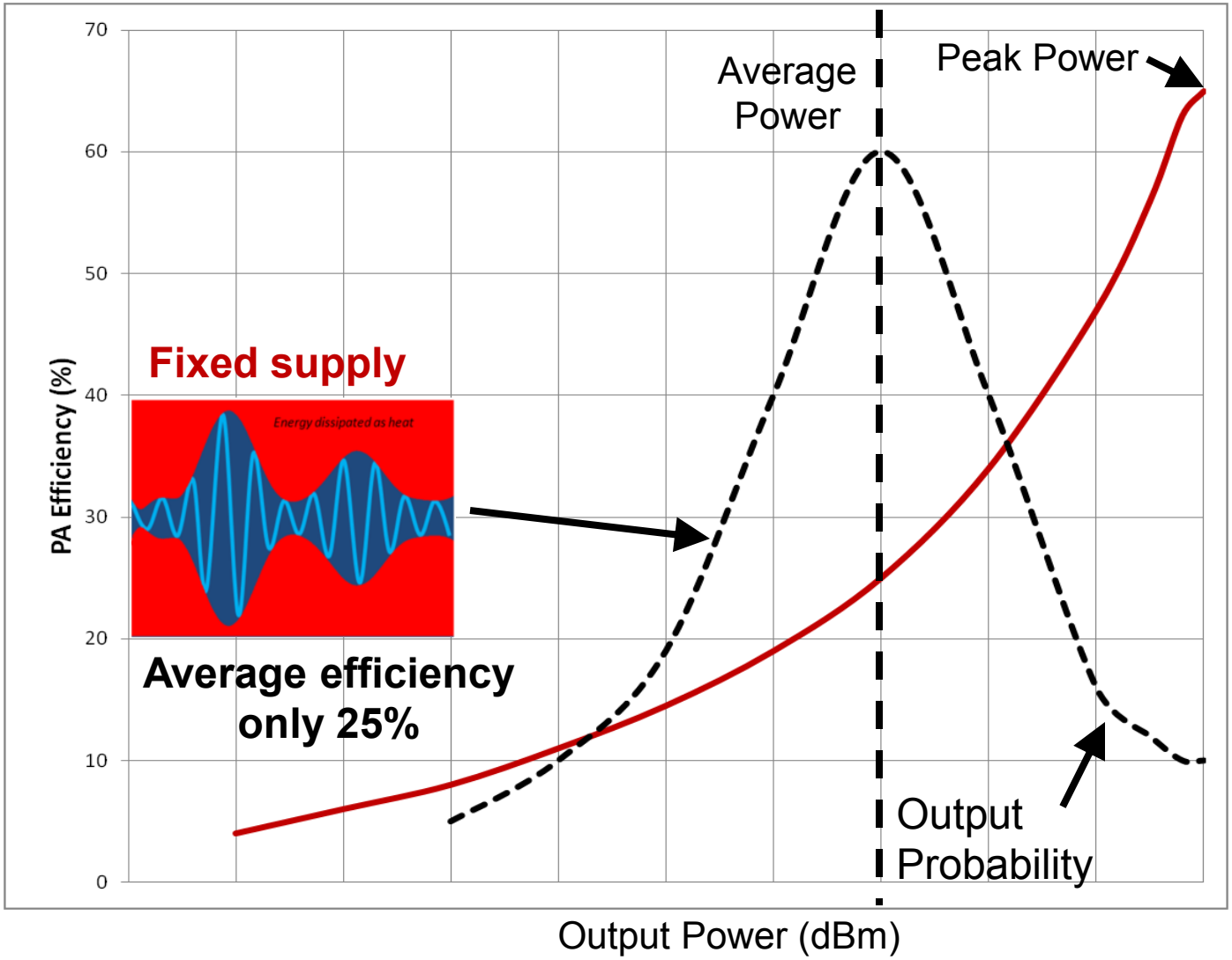


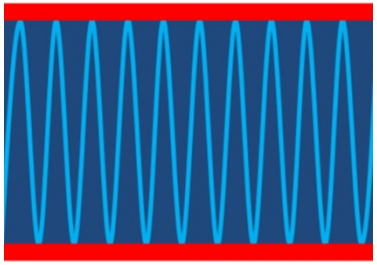
Loss Breakdown



Envelope Tracking

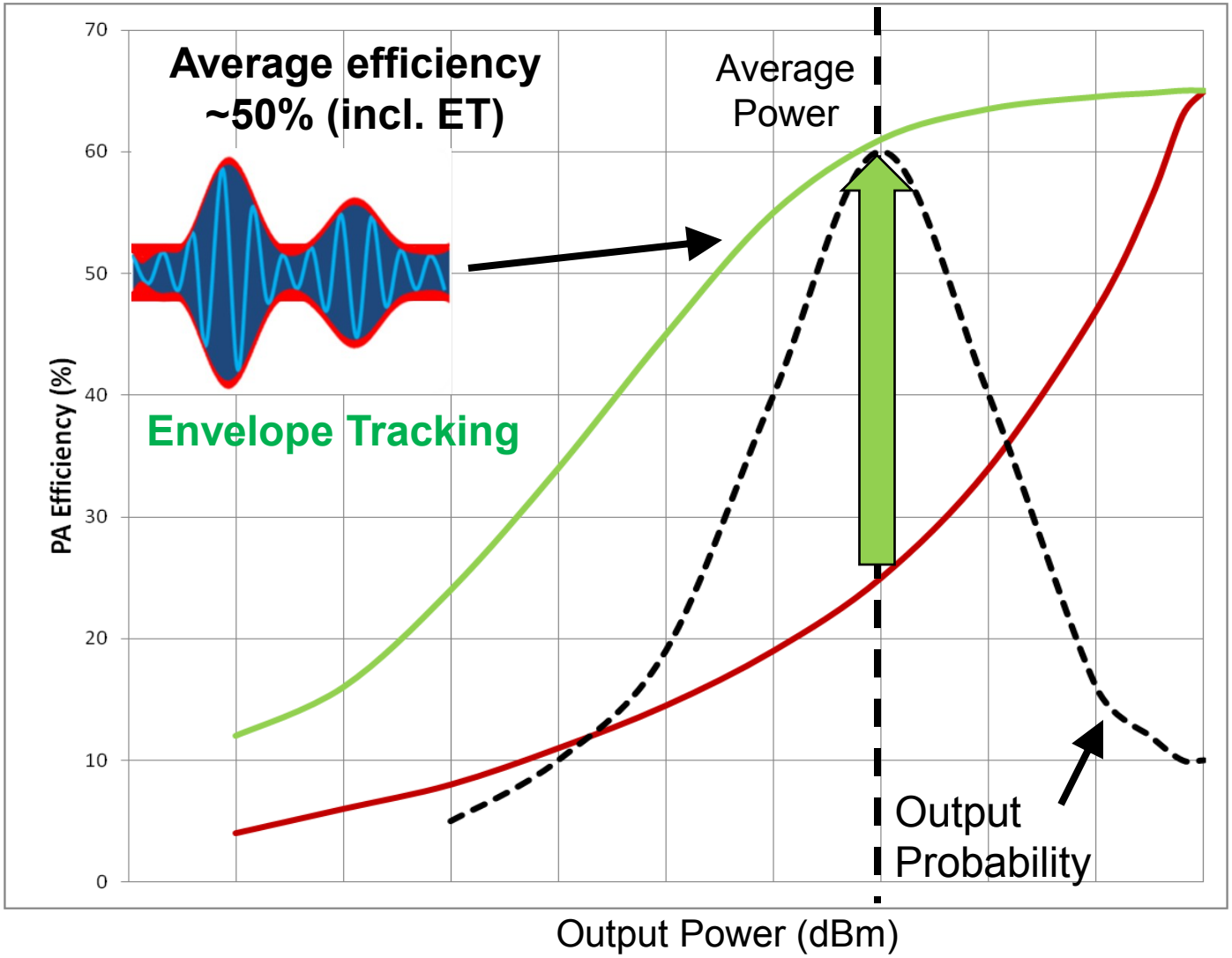
Effect of Peak-to-average-power-ratio



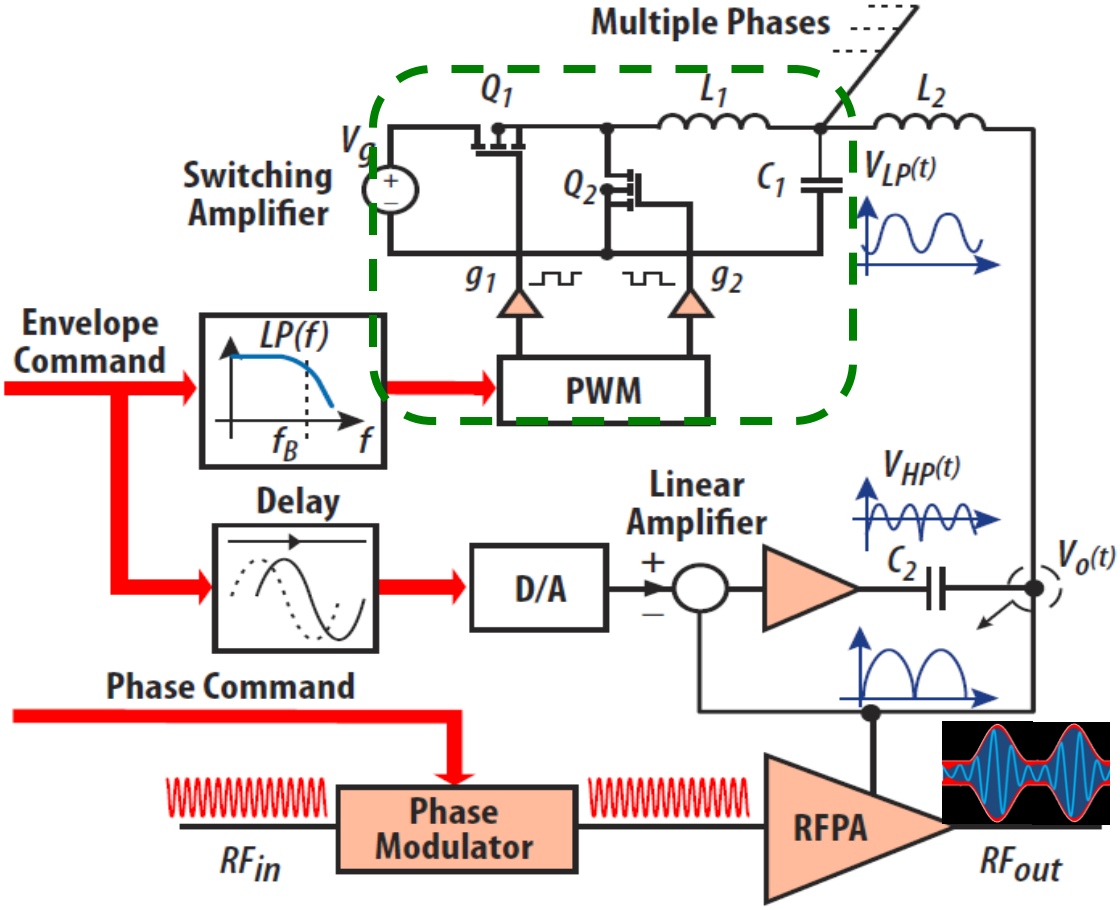


Peak efficiency up to 65%

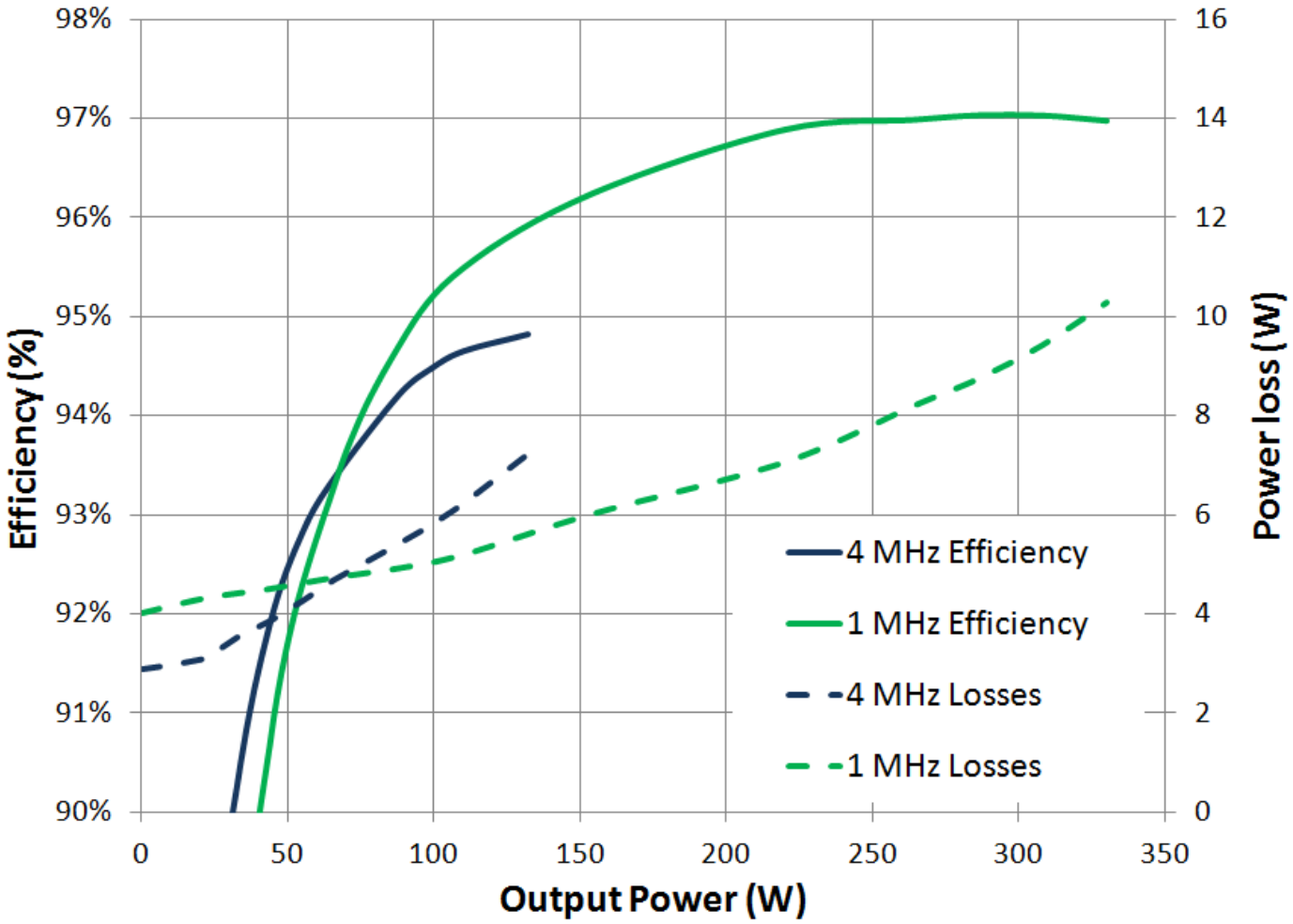
Effect of ET


Average efficiency
~50% (incl. ET)
Envelope Tracking
Average
Power
Output
Probability
PA Efficiency (%)
Output Power (dBm)
70
60
50
40
30
20
10
0

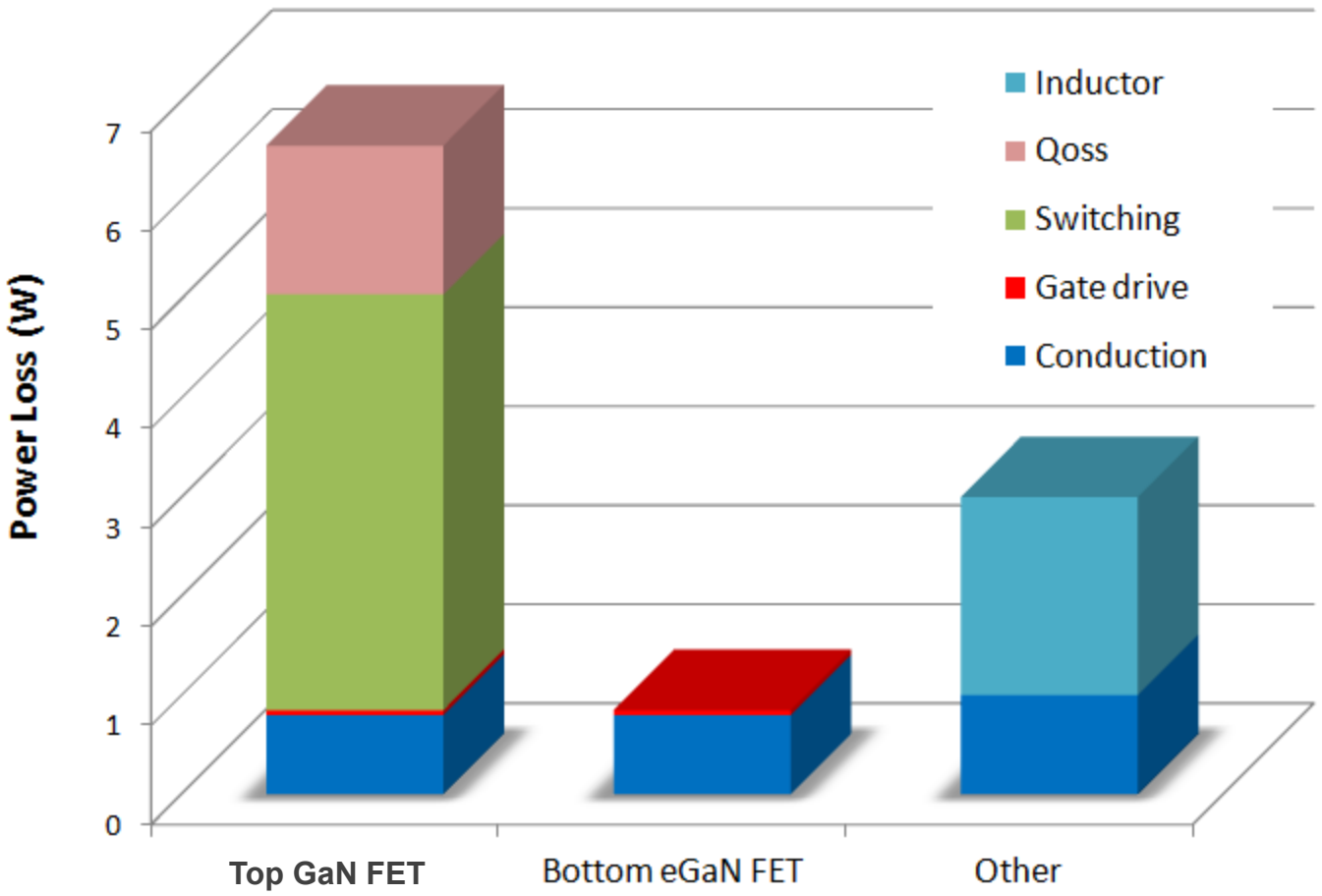
Linear-assisted Buck ET



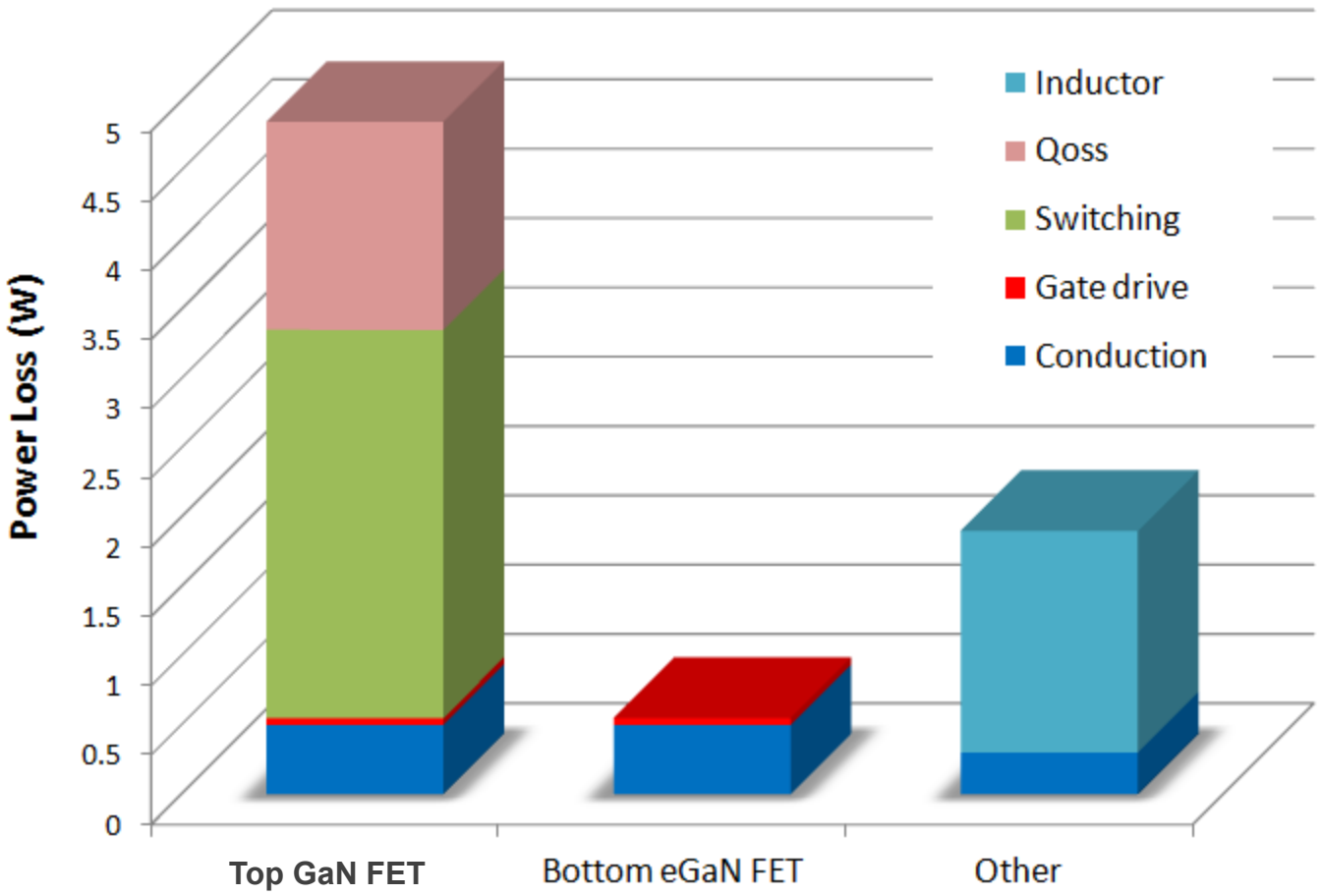
Efficiency


98%
97%
96%
95%
94%
93%
92%
91%
90%
Efficiency (%)
16
14
12
10
8
6
4
2
0
Power loss (W)
0
50
100
150
200
250
300
350
Output Power (W)
4 MHz Efficiency
1 MHz Efficiency
4 MHz Losses
1 MHz Losses

1MHz Loss Breakdown



4MHz Loss Breakdown



Summary

- eGaN FETs are superior compared with power MOSFETs in hard-switched and resonant converters
- eGaN FETs operate efficiently in multi-megahertz envelope tracking and wireless power converters

EPC
EFFICIENT POWER CONVERSION

The end of the road for silicon…..

is the beginning of the eGaN FET journey!