eGaN® FET Application: High Frequency Resonant Converters

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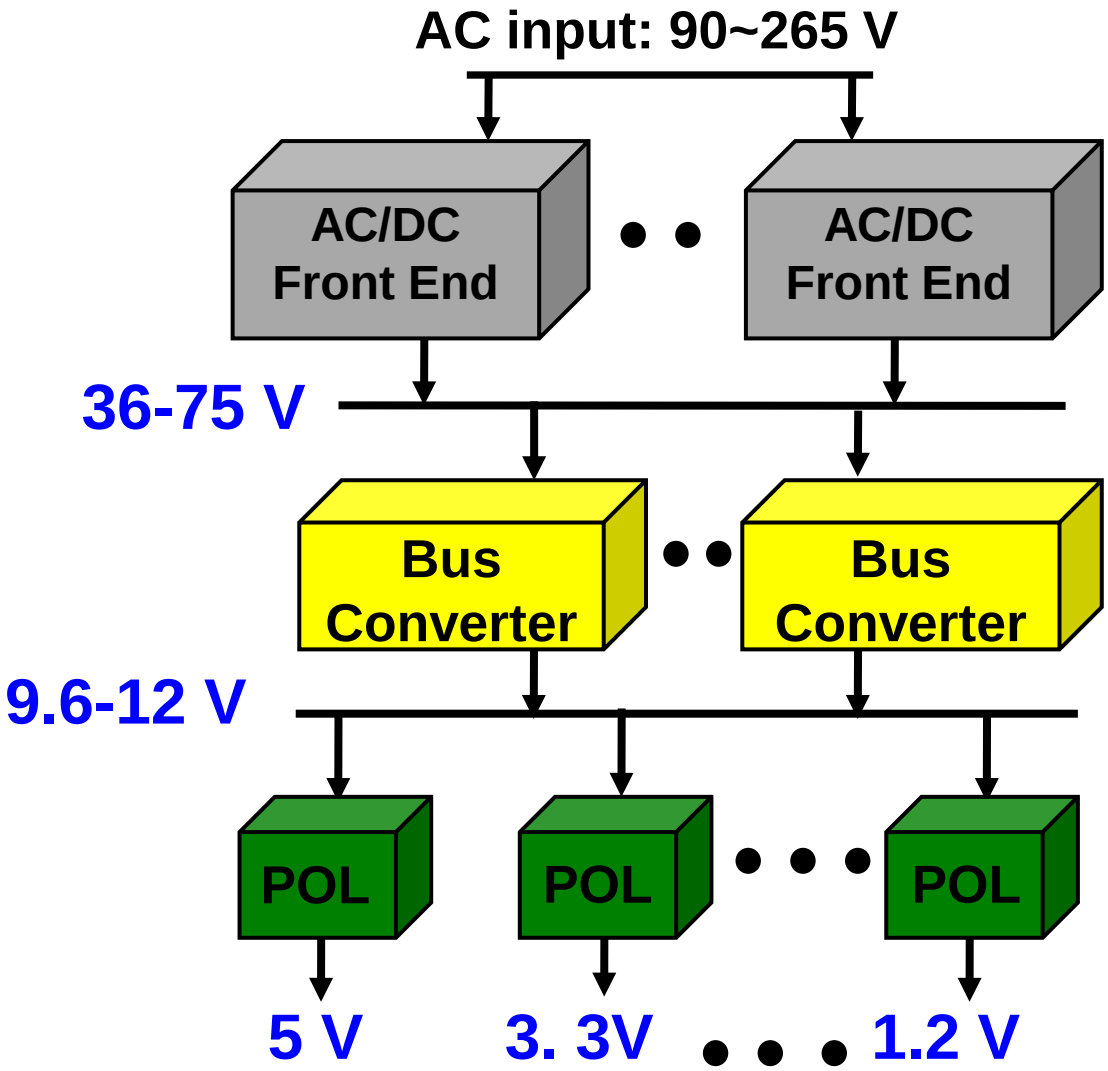
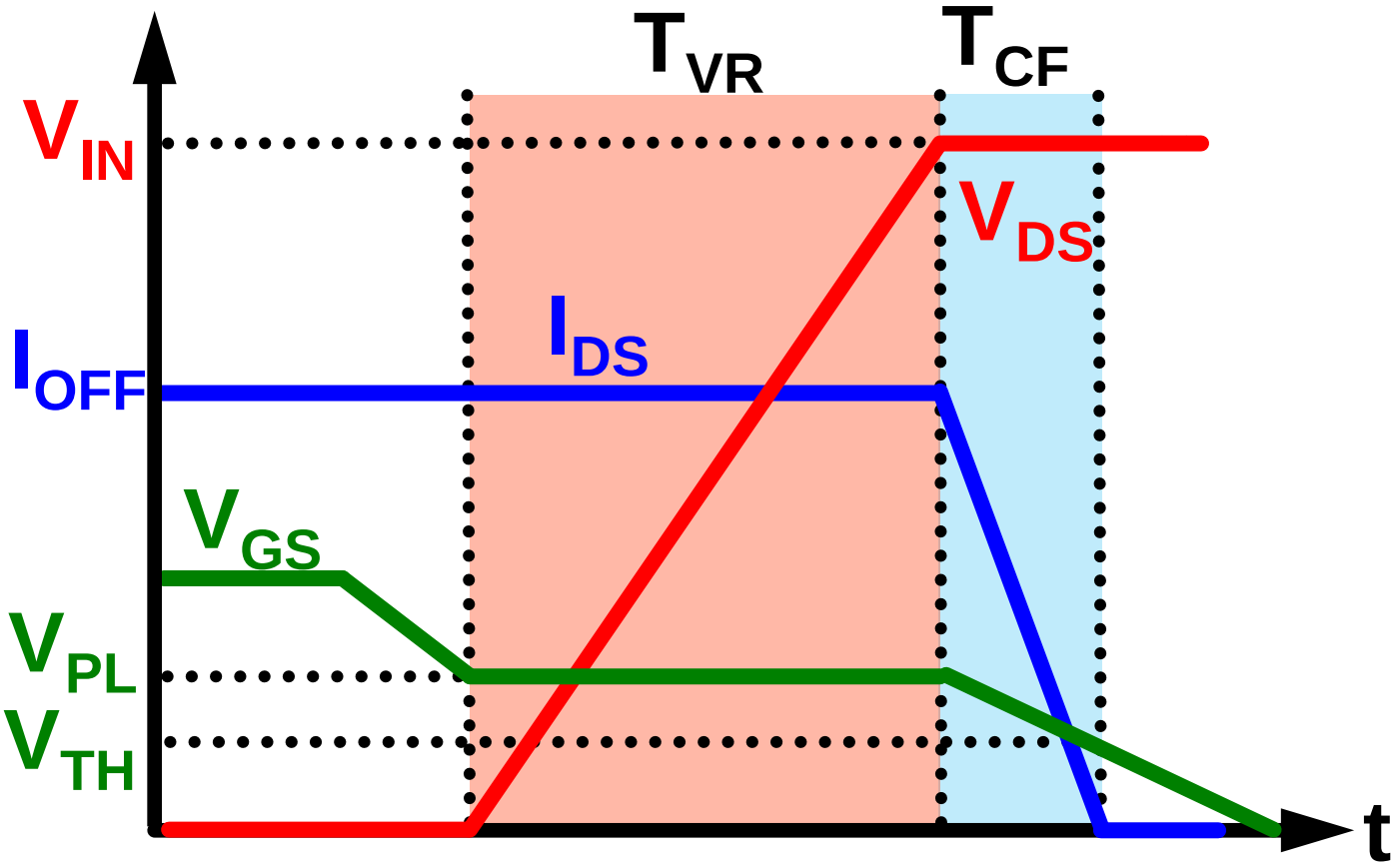
Agenda

- Overview of Power Architecture
- Hard Switching Converters with eGaN®FETs
- Soft Switching Converters with eGaN®FETs
- Summary

Intermediate Bus Architecture



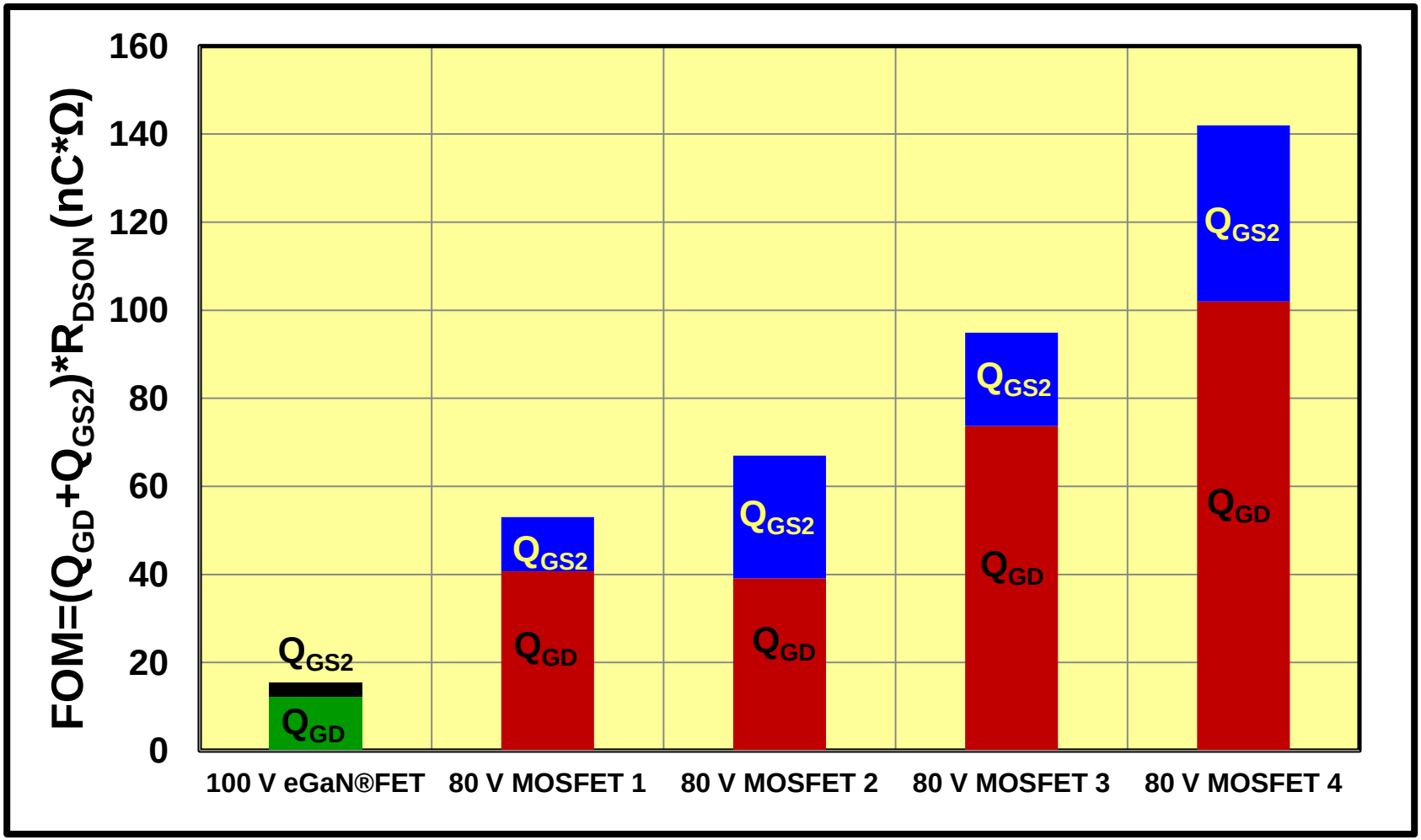
Ideal Hard Switching



$$P_{T_{VR}} \approx \frac{V_{IN} * I_{OFF} * Q_{GD}}{2 * I_G}$$

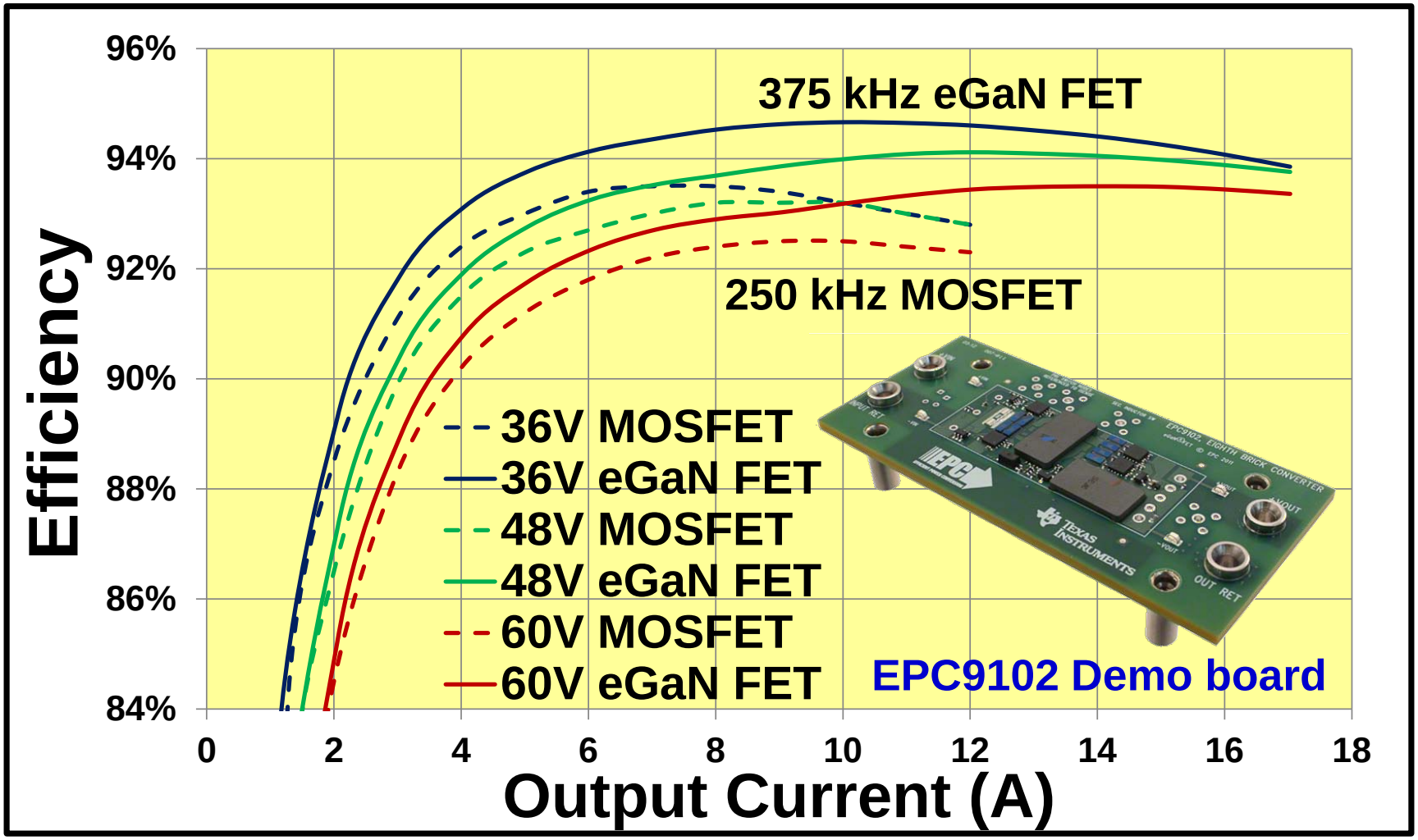
$$P_{T_{CF}} \approx \frac{V_{IN} * I_{OFF} * Q_{GS2}}{2 * I_G}$$

100V Hard Switching FOM



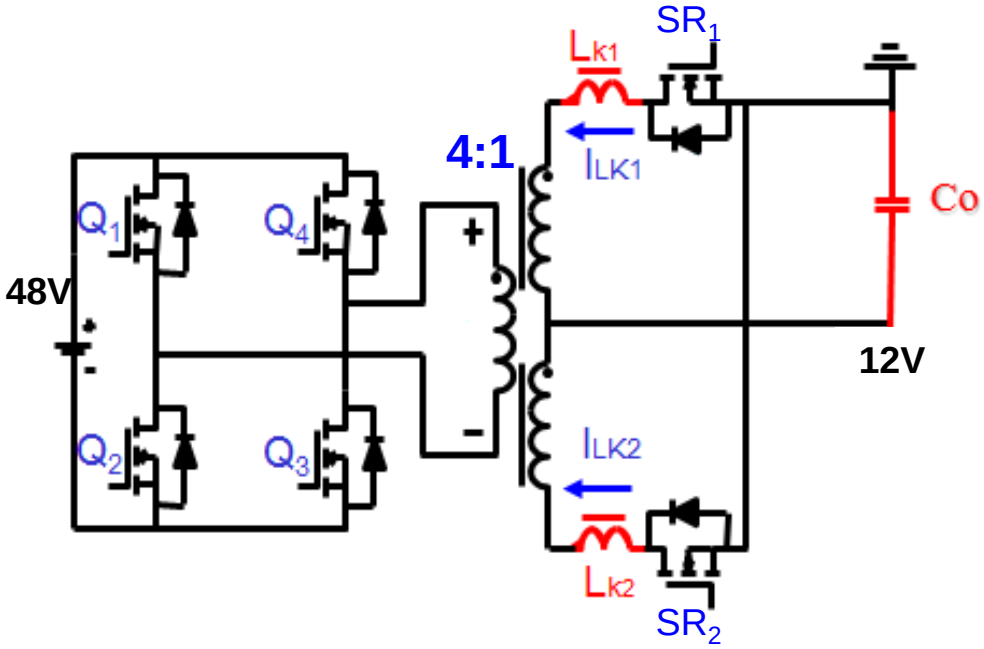
V_{DS}=0.5*V_{DS} , I_{DS}= 15 A

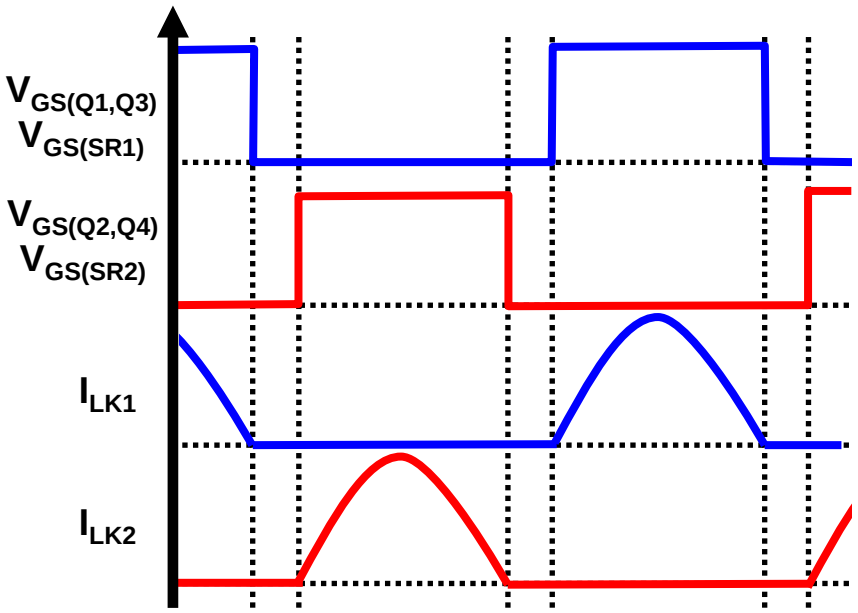
Hard Switching Design



36 - 60 Vin, 12 Vout, 200 W, 375 kHz

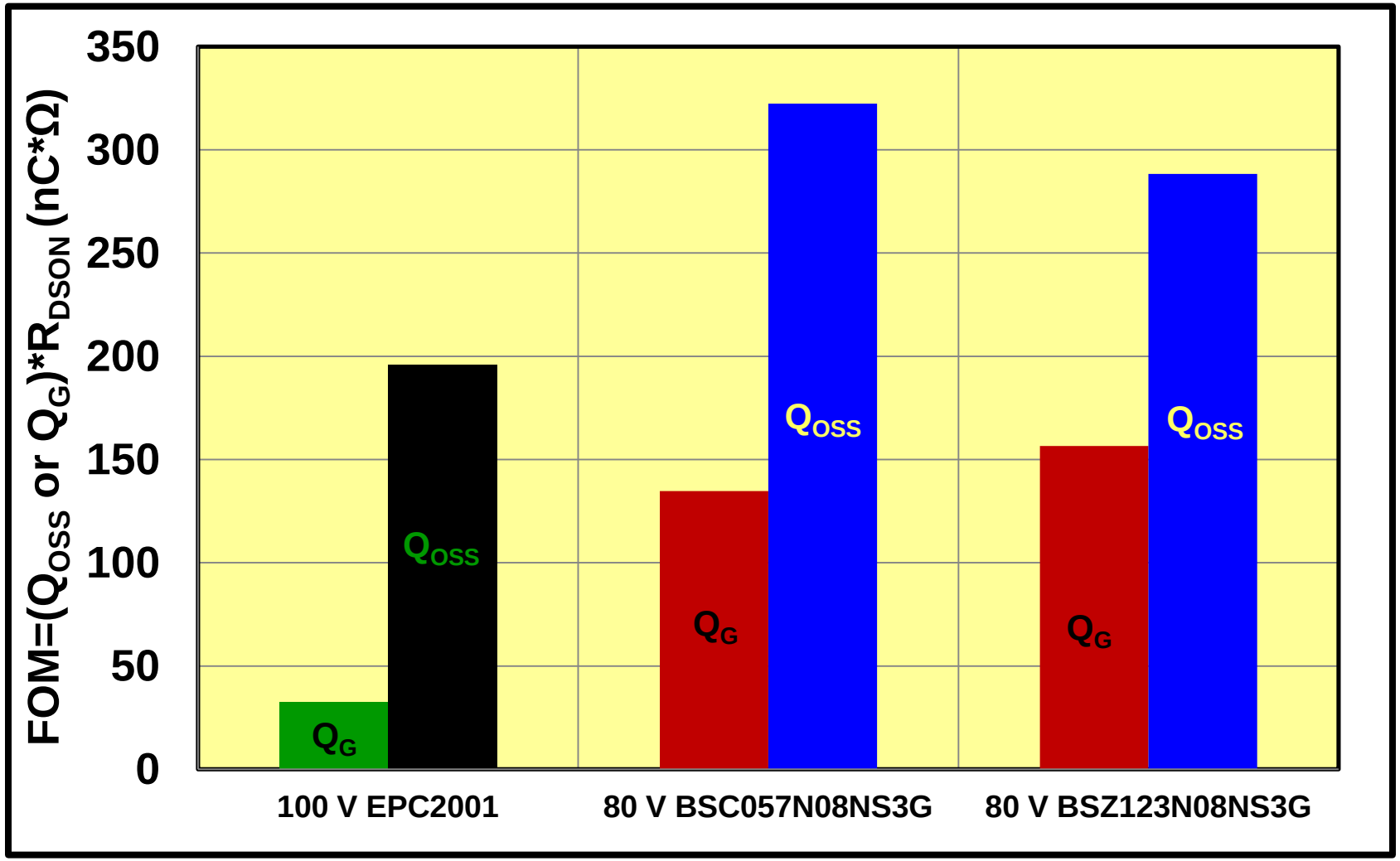
High Frequency DC/DC Transformer





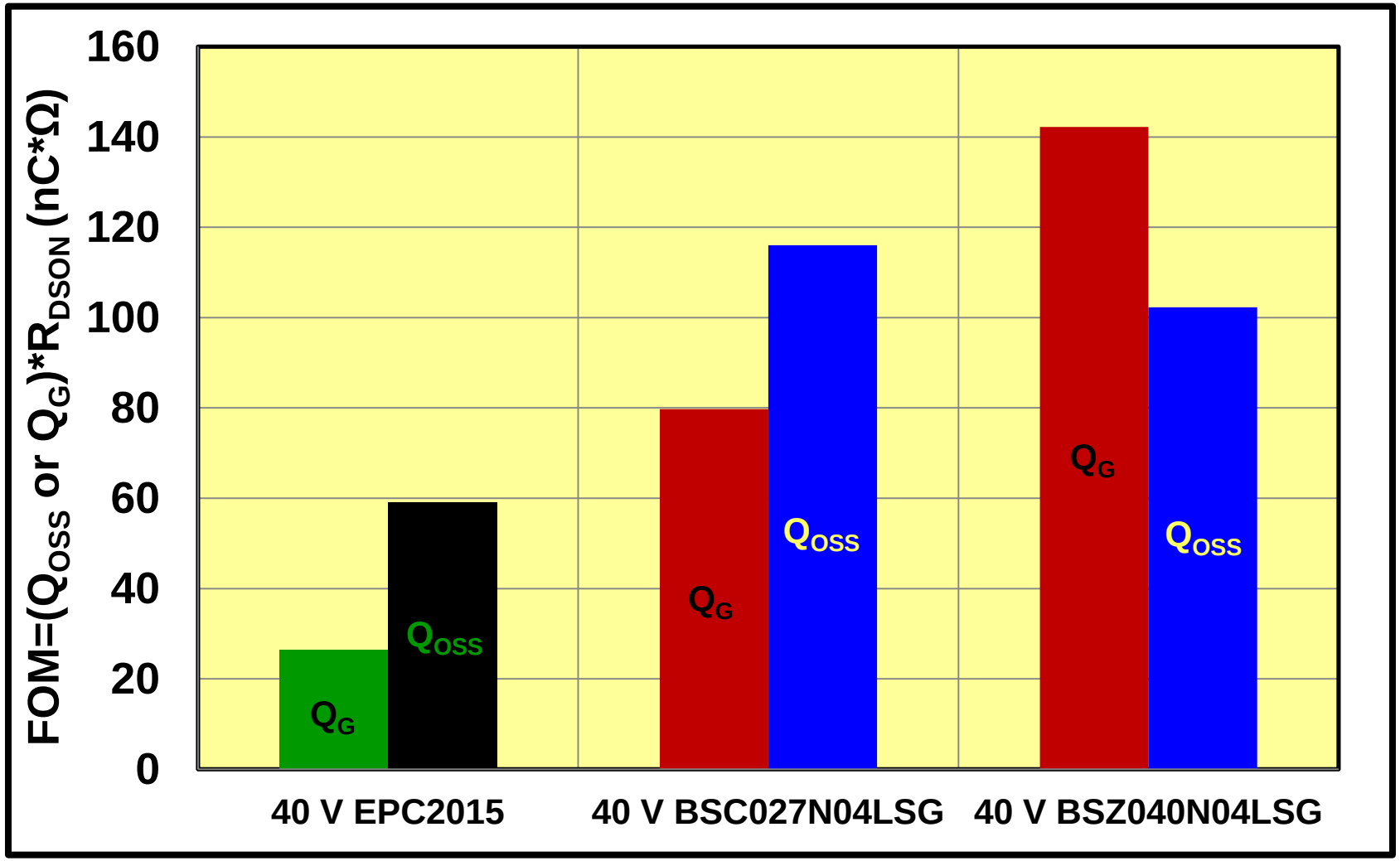
Ref: Y. Ren, M. Xu, J. Sun, and F. C. Lee, "A family of high power density unregulated bus converters," IEEE Trans. Power Electron., vol. 20, no. 5, pp. 1045–1054, Sep. 2005.

100V Soft Switching FOM



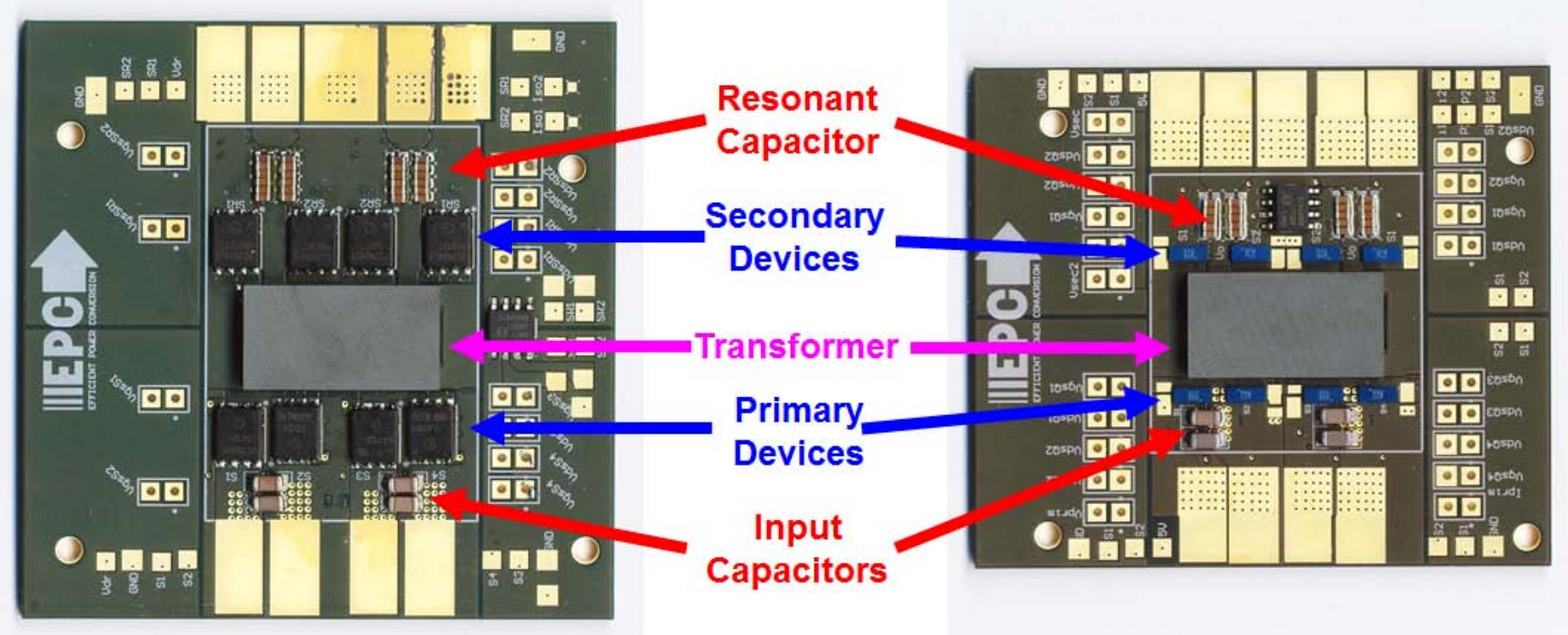
V_{DS}=48 V

40V Soft Switching FOM



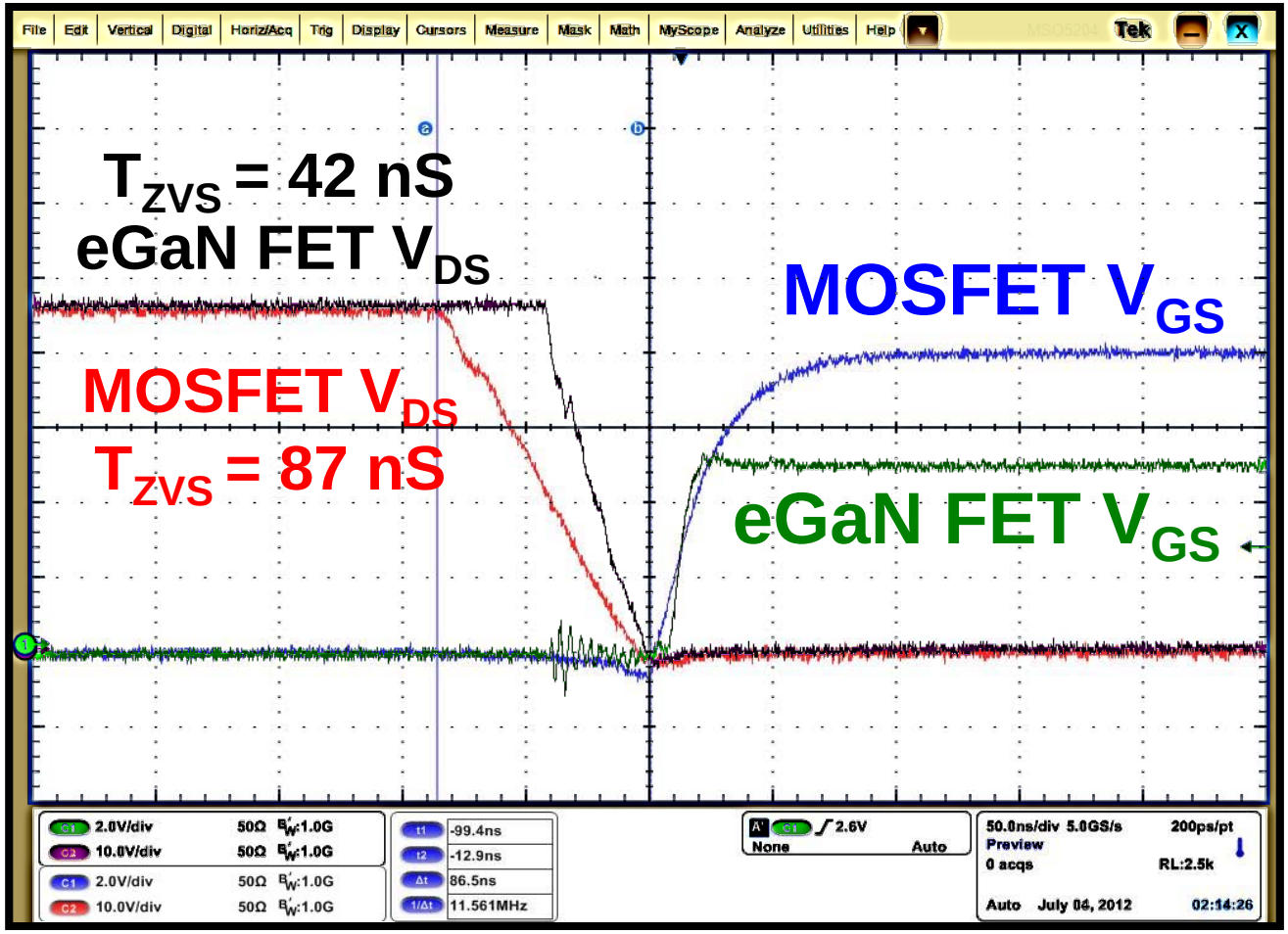
V_{DS}=48 V

eGaN® FET vs MOSFET



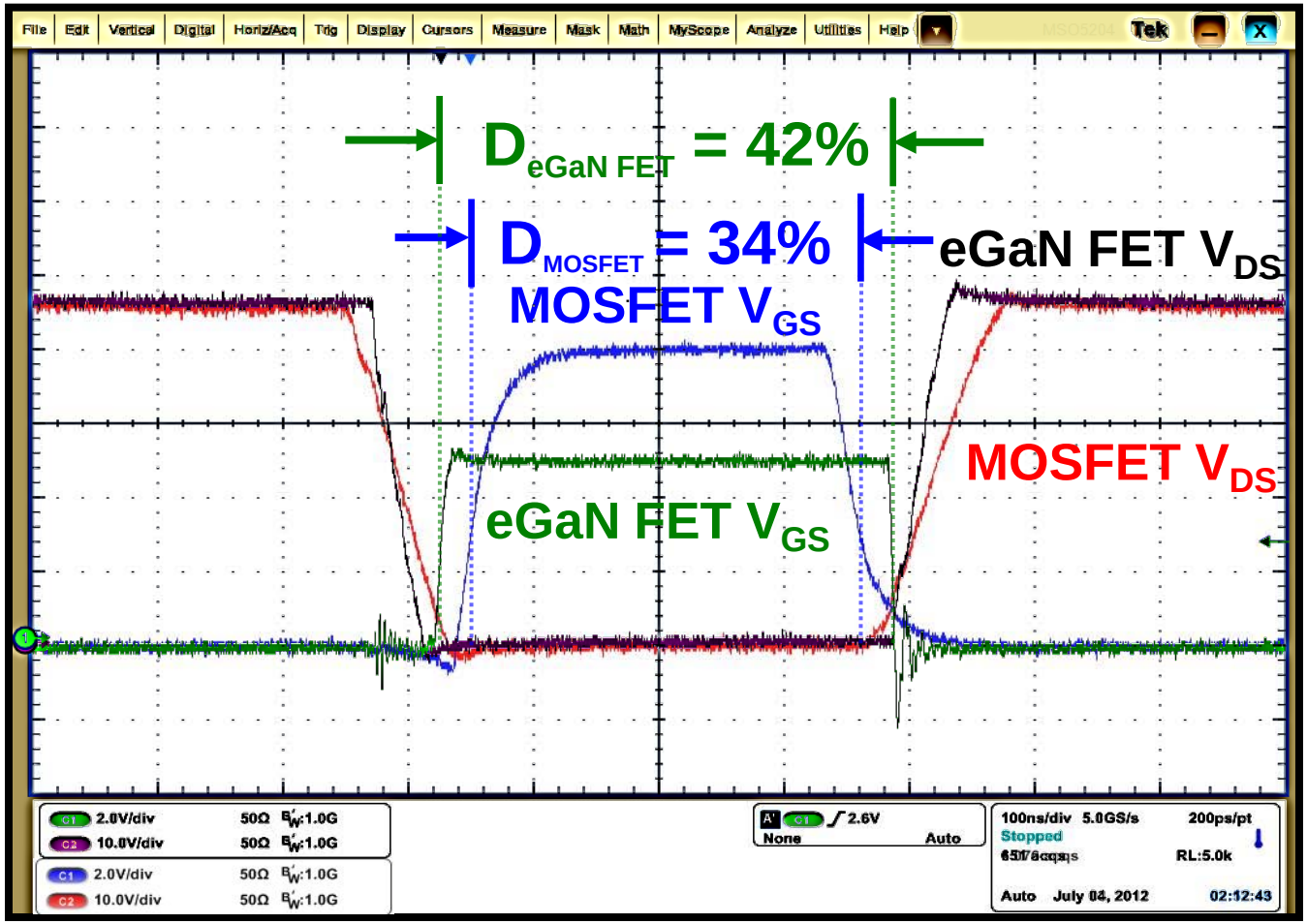
MOSFET vs. eGaN® FET

ZVS Switching Comparison



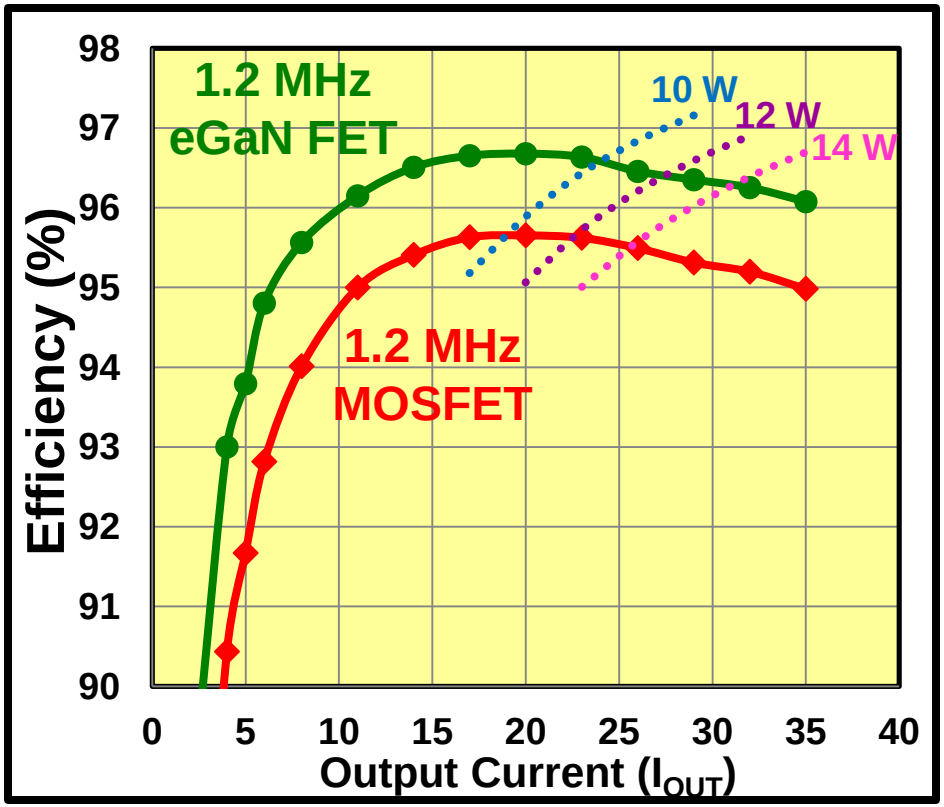
F_S = 1.2 MHz, V_{IN} = 48 V, and V_{OUT} ≈ 12 V

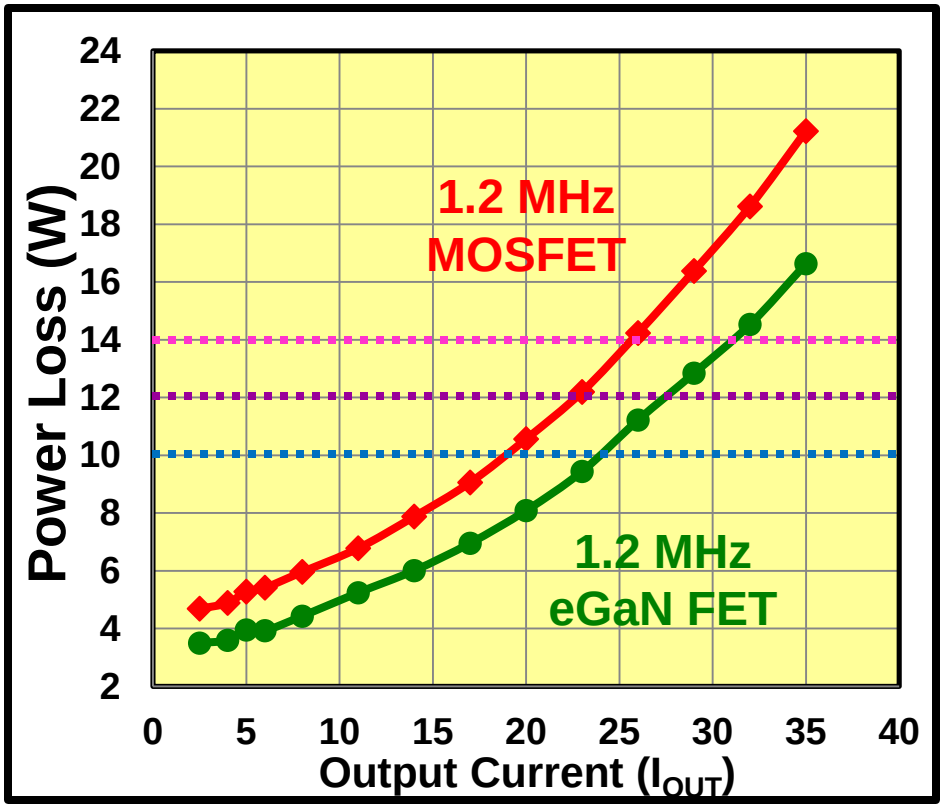
Duty Cycle Comparison



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

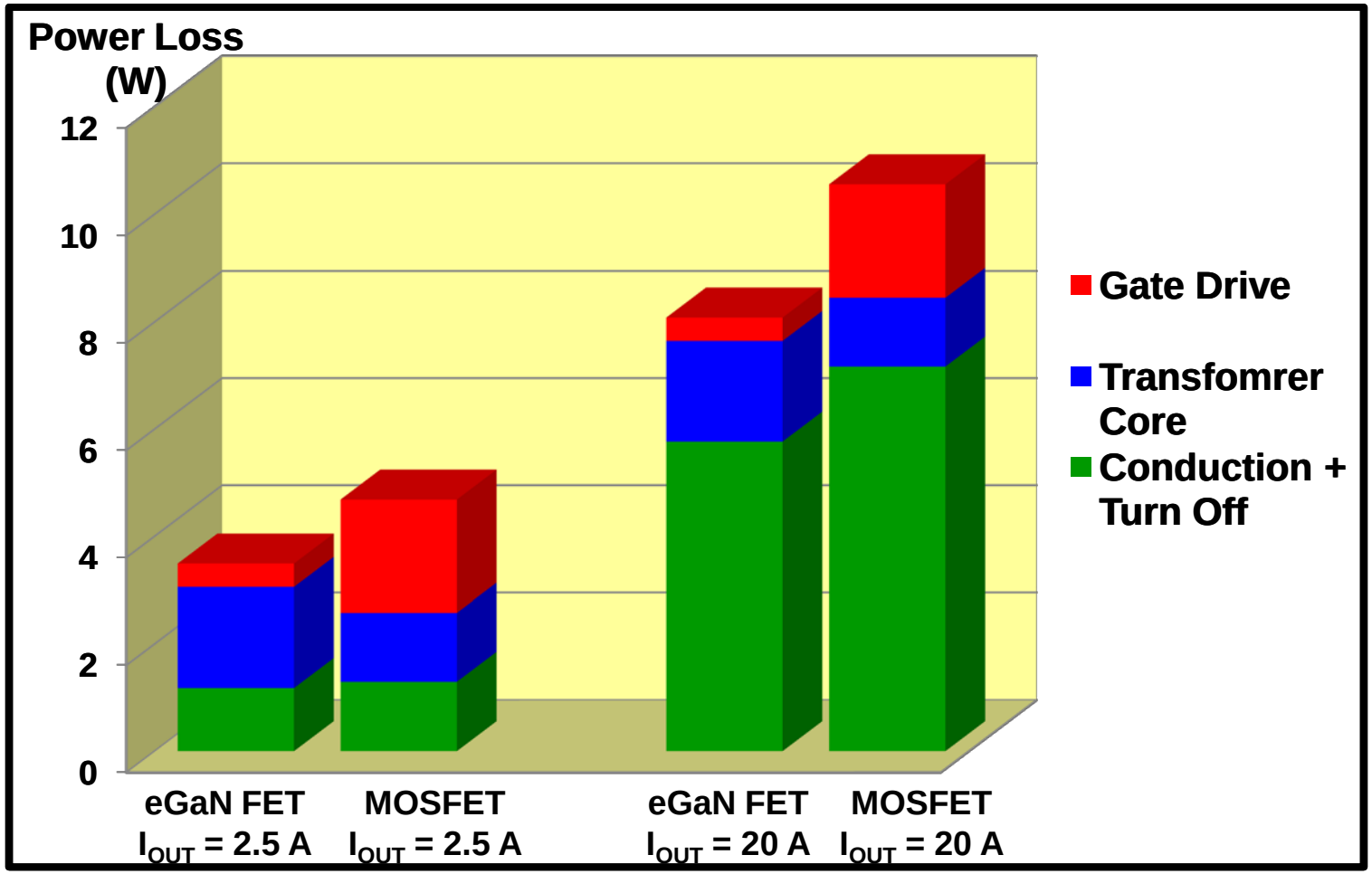
Efficiency Comparison





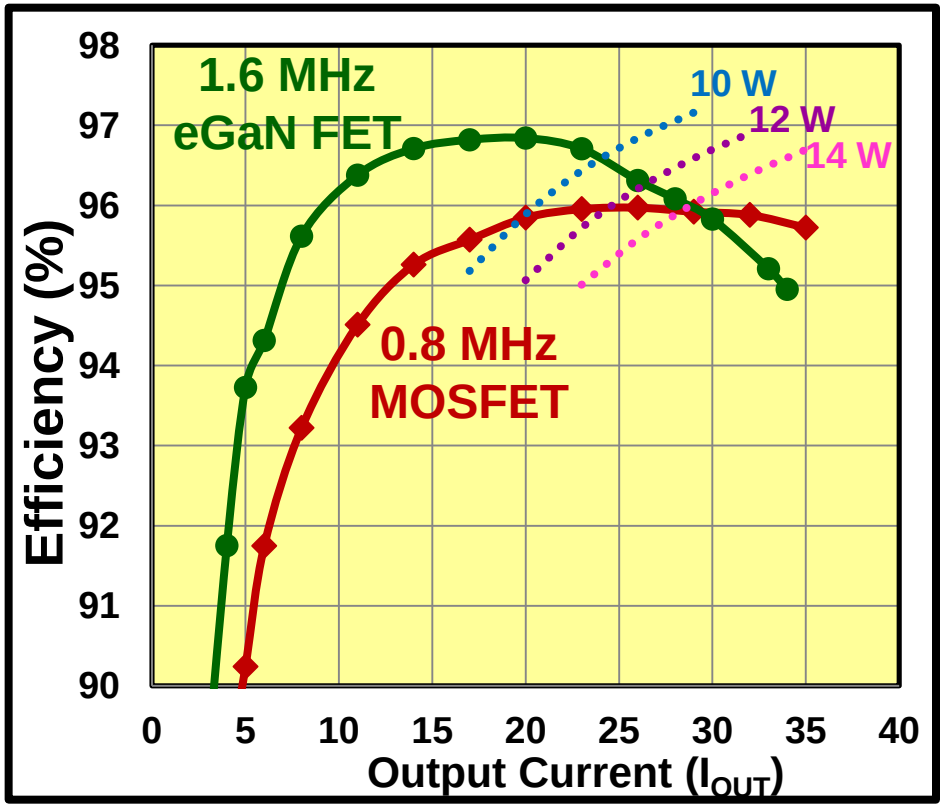
F_S = 1.2 MHz, V_{IN} = 48 V, and $V_{OUT} \approx$ 12 V

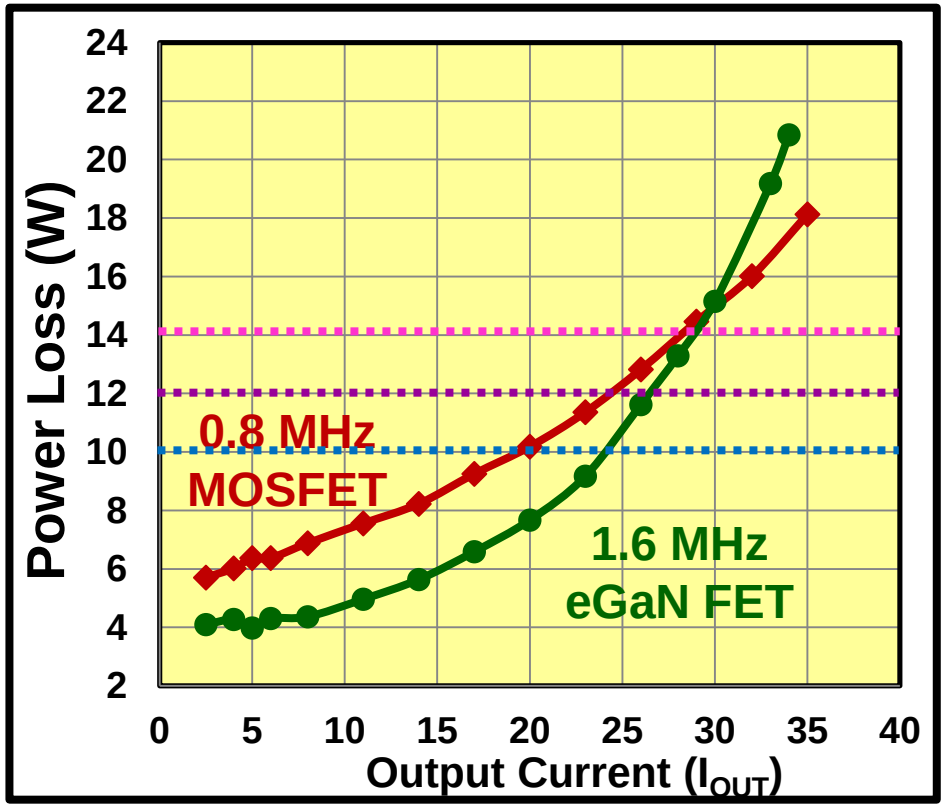
Loss Breakdown



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

Frequency Capability



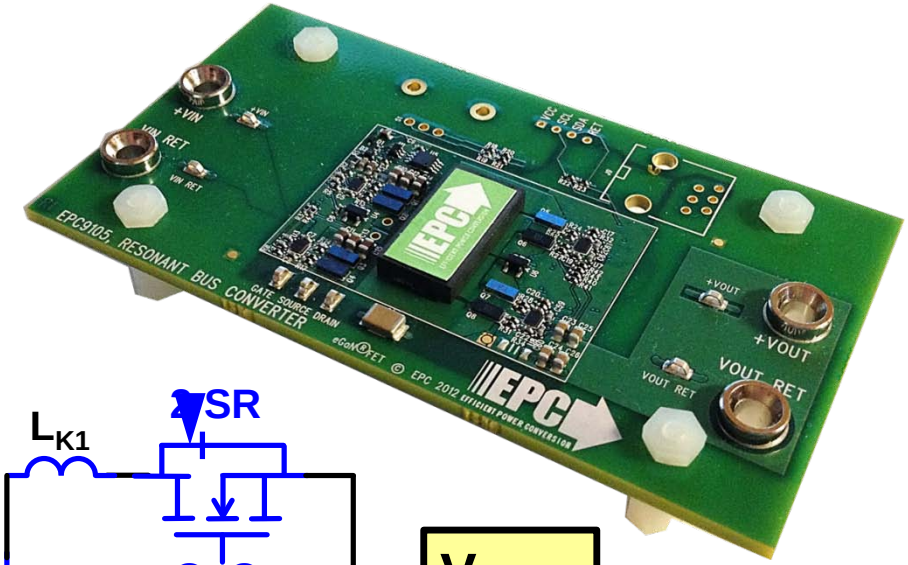


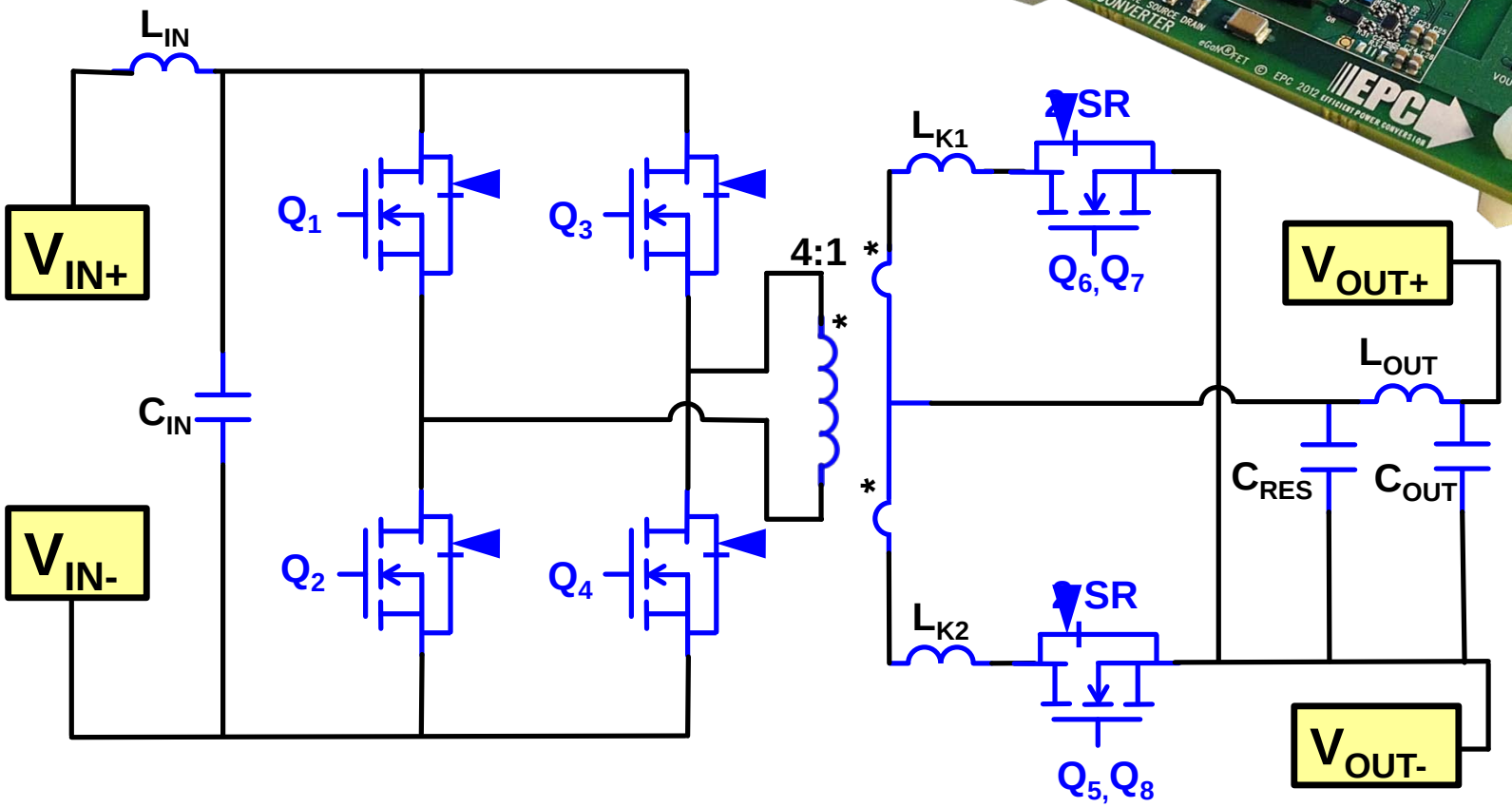
V_{IN} = 48 V, and V_{OUT} ≈ 12 V

EPC9105 Bus Converter

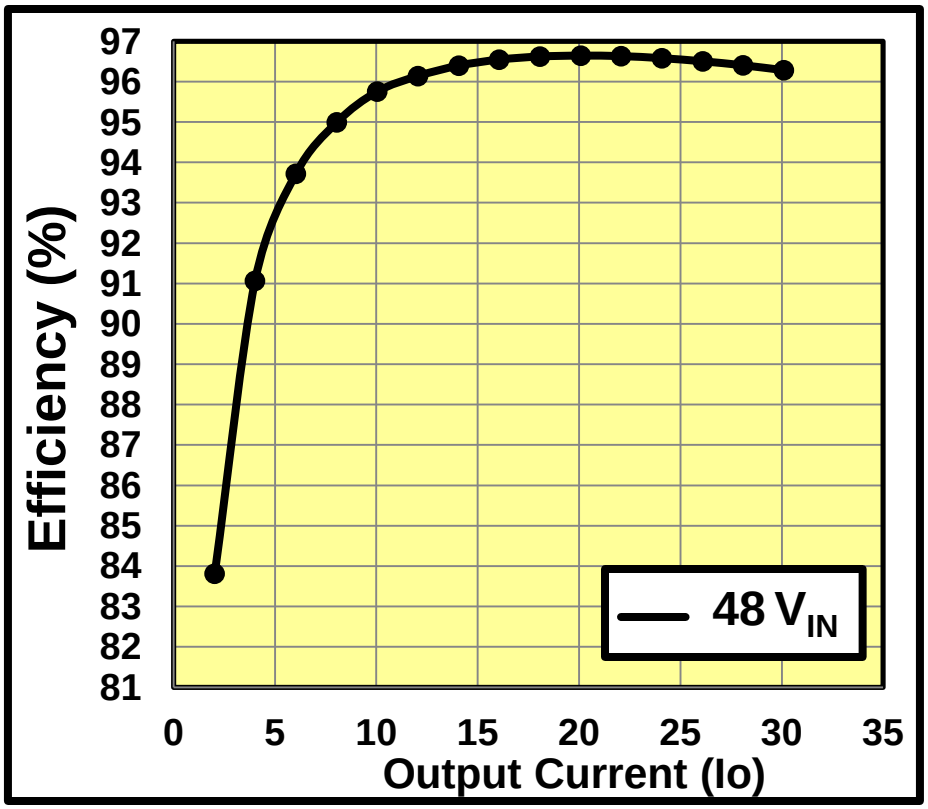
EPC9105 Demonstration Board

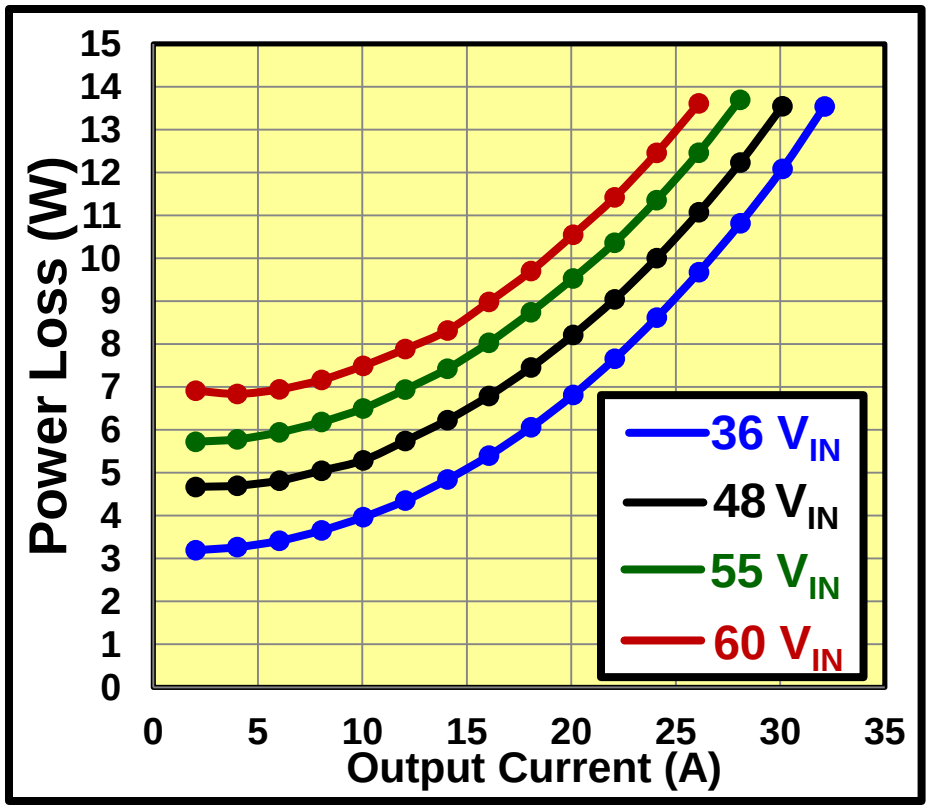
36 - 60 V_{IN}, 12 V_{OUT}, 350 W, 1.2 MHz





EPC9105 Bus Converter





F_S = 1.2 MHz, V_{IN} = 36-60 V, and $V_{OUT} \approx V_{IN}/4$

Summary

eGaN FETs improve high frequency resonant converter performance

- **Lower output charge**
- **Lower gate charge**
- **More power delivery per cycle**

EPC
EFFICIENT POWER CONVERSION

The end of the road for silicon…..

is the beginning of the eGaN FET journey!