

A green road sign on a wooden post stands on the left side of a road. The road stretches into the distance towards a city skyline at sunset. The sky is filled with white and yellow clouds, and the sun is low on the horizon, creating a warm glow. The sign contains the text 'eGaN® FET' and '昂首阔步前进'.

eGaN® FET
昂首阔步前进

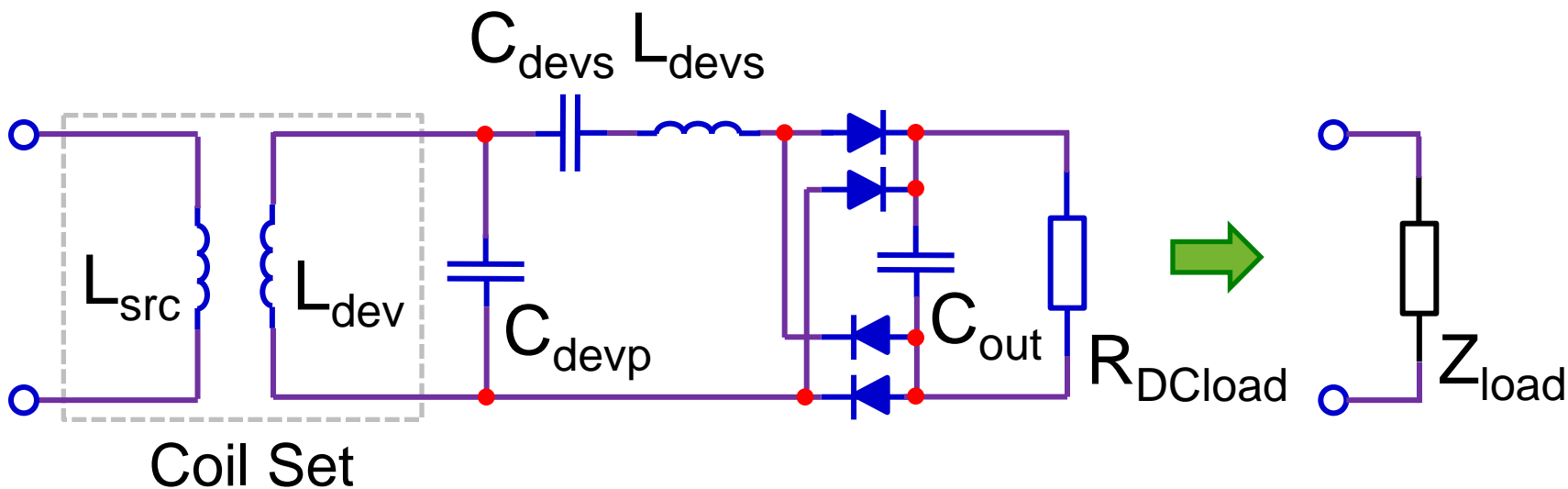
采用氮化镓场效应晶体管(eGaN® FET)的 无线电源传送解决方案

宜普电源转换公司

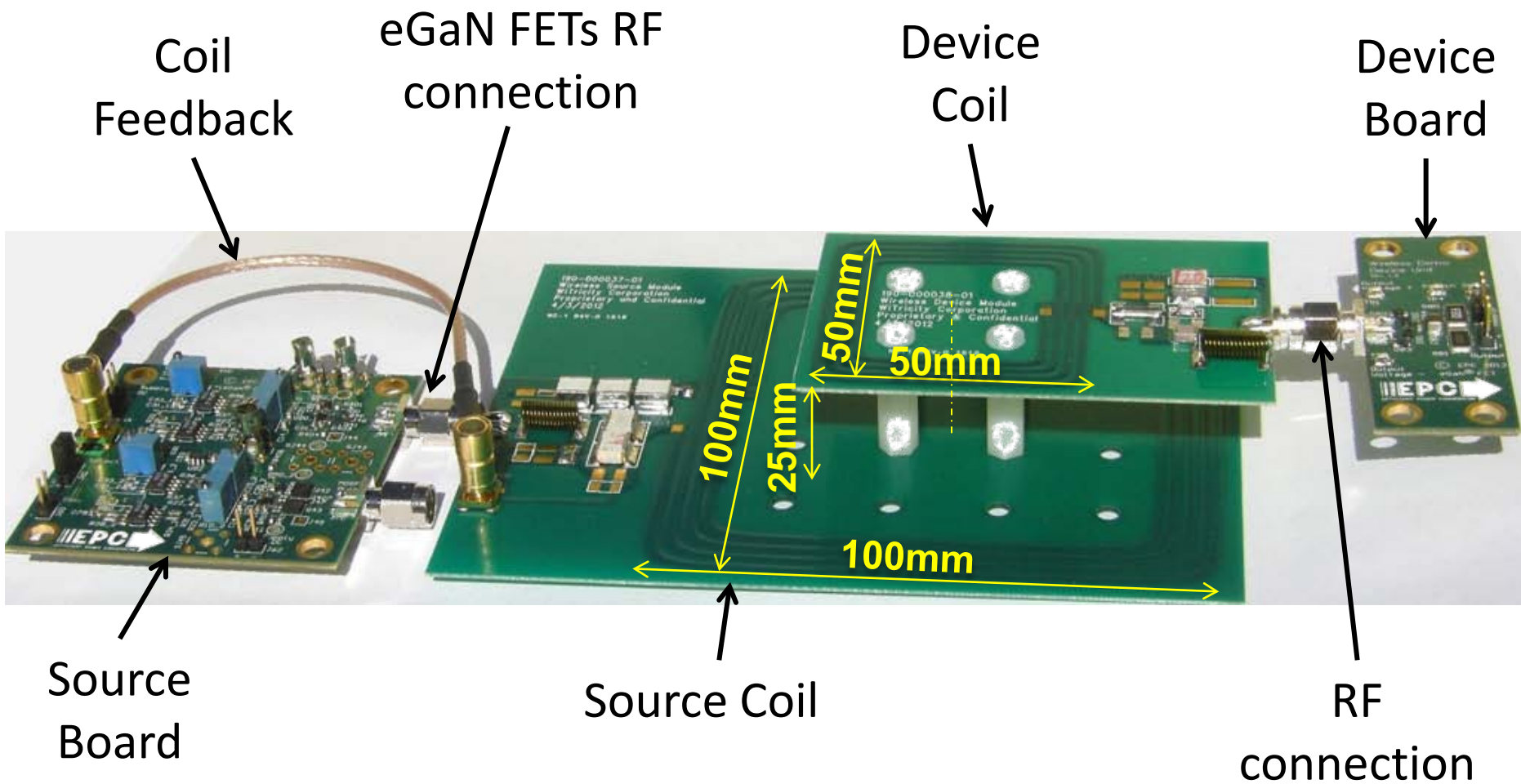
- 无线电源拓扑概述
- 每种拓扑所取得的无线电源结果
- 总结

- 输出功率 < 30 W
- 松散耦合、根据A4WP标准的6.78 MHz (ISM频带)
- 探讨不同的拓扑：
 - D类放大器 (电流及电压模式)
 - E类放大器
 - ZVS电压模式的D类放大器

为易于比较不同拓扑而简化了的线圈组合表述

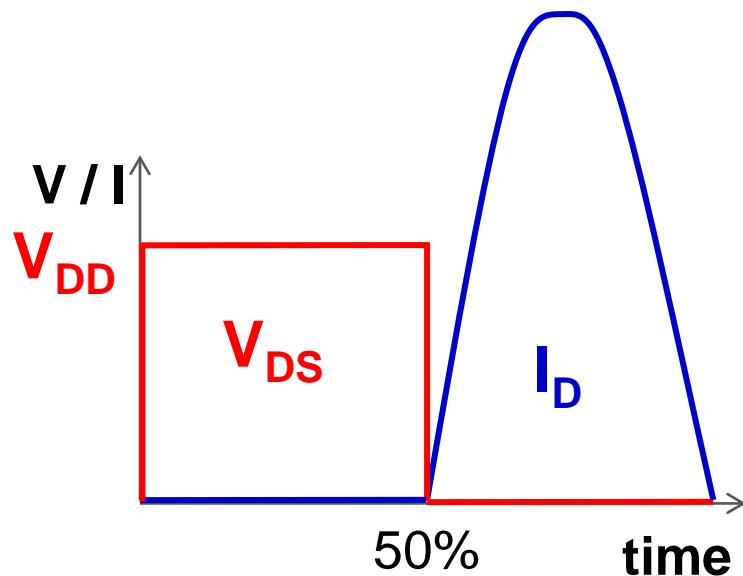
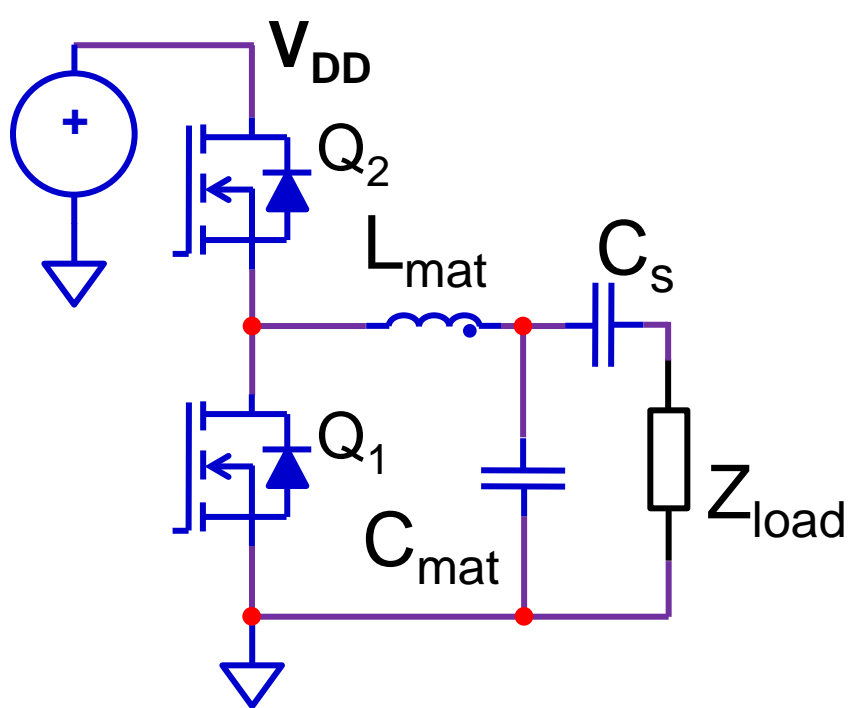


实验性设置



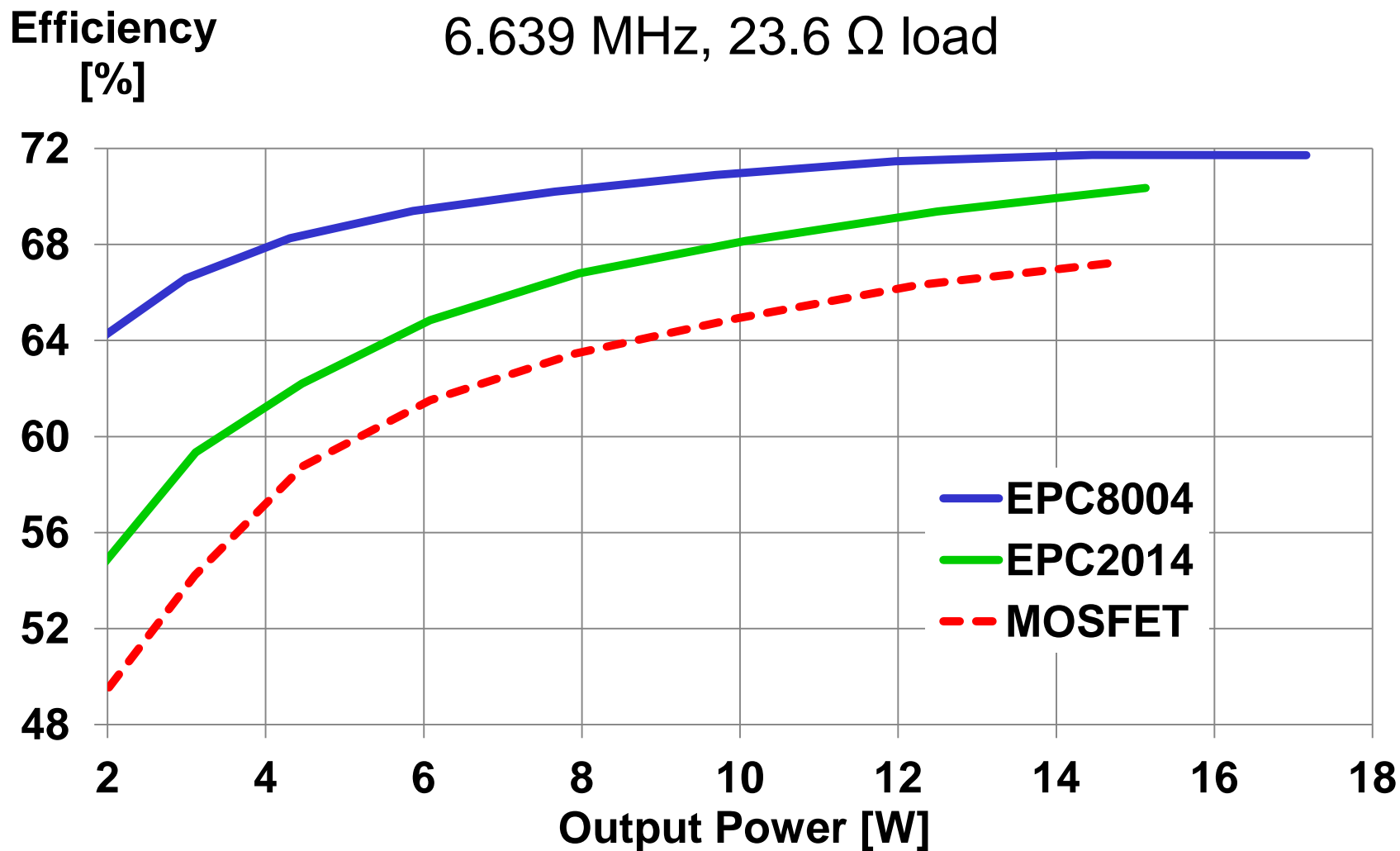
传统的电压模式D类放大器

- 开关电压额定值 = 供电 (V_{DD})
- 需要具电平转换功能的栅极驱动器
- C_{OSS} 对损耗的影响非常重要



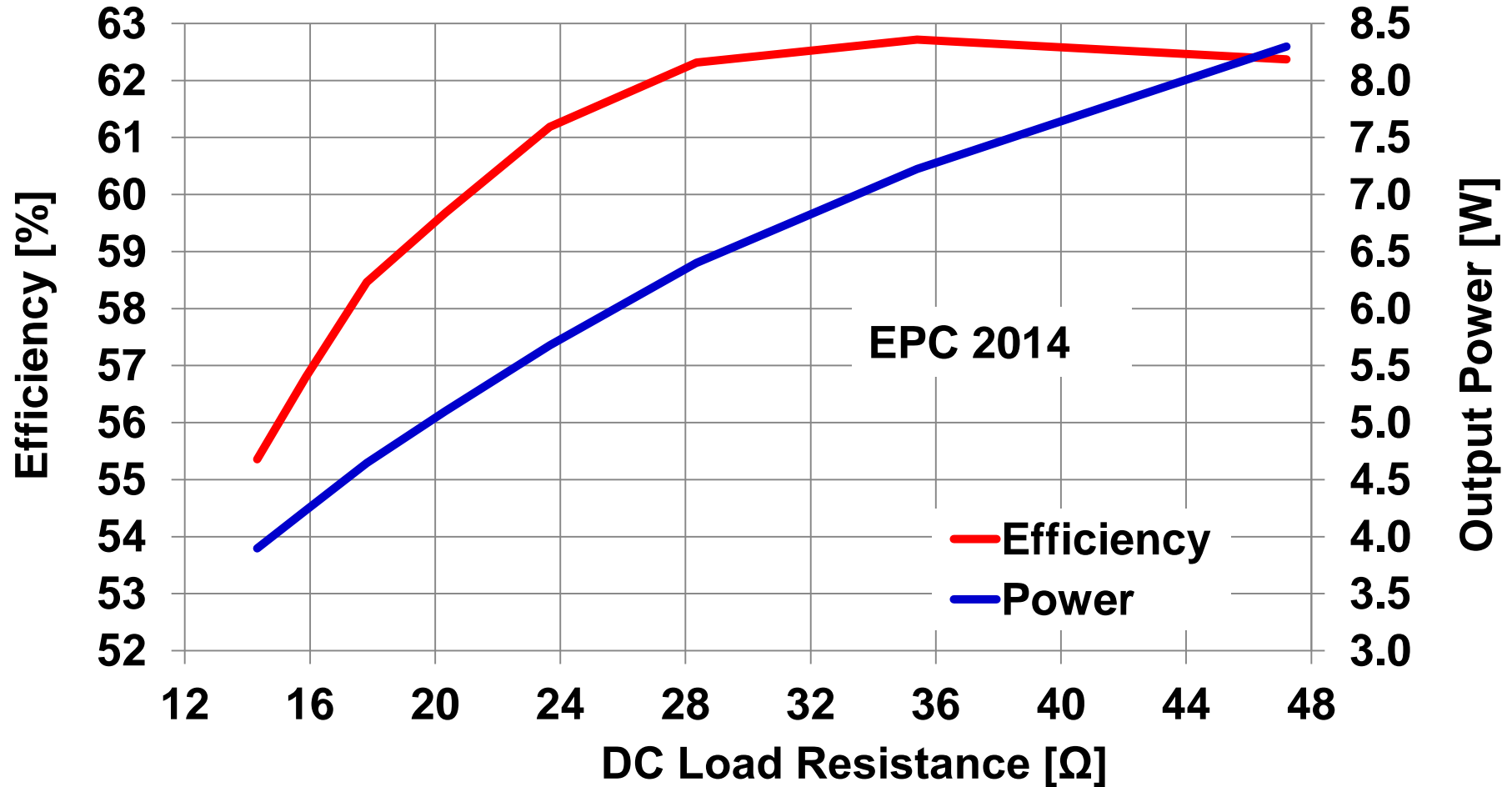
Ideal Waveforms

电压模式D类放大器的效率



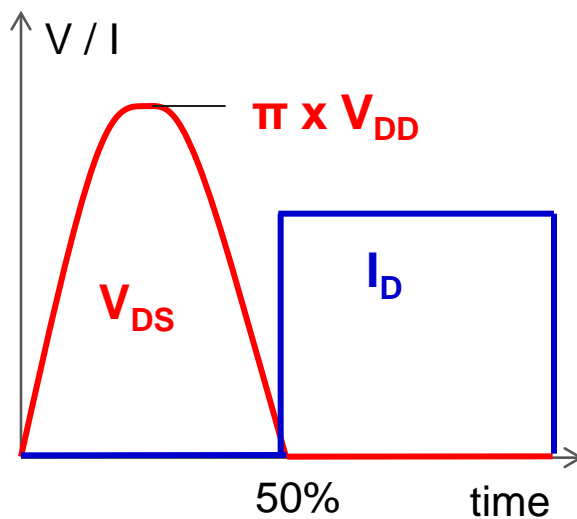
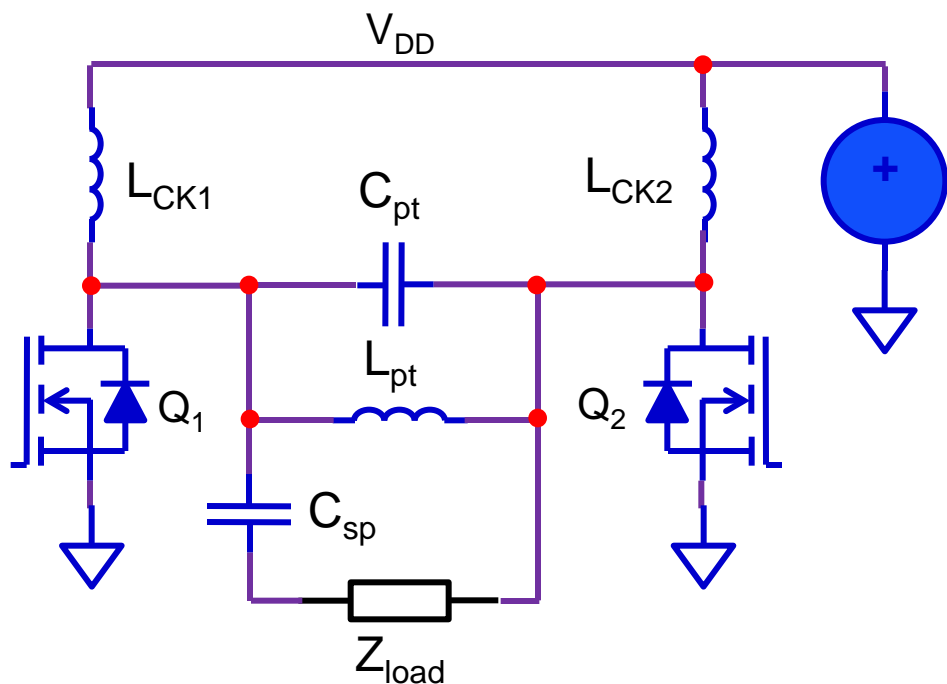
负载对电压模式D类放大器效率的影响

6.699MHz, Fixed 14V supply



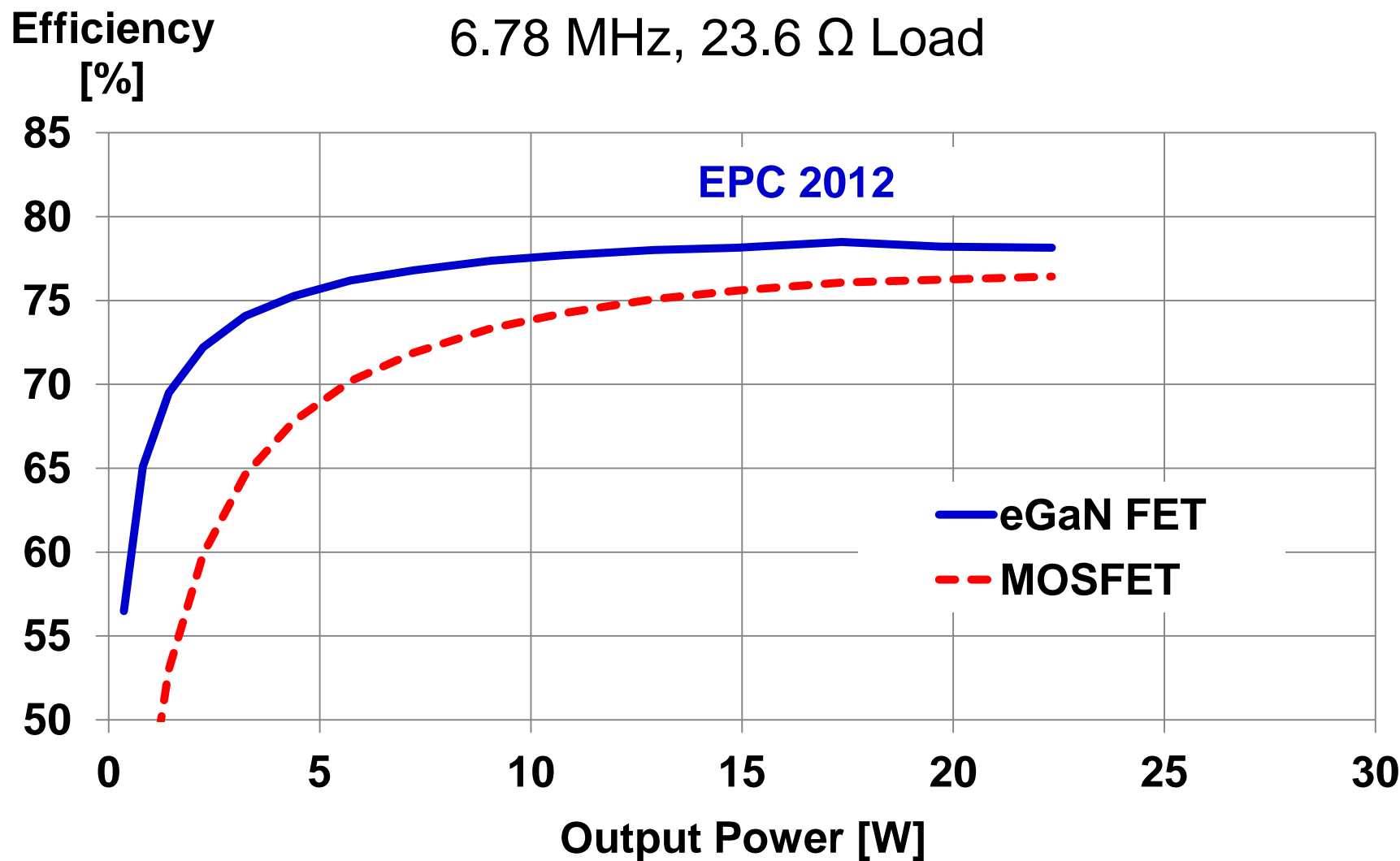
电流模式D类放大器

- 与MOSFET相比，EPC2012场效应晶体管的品质因数较低
- C_{OSS} 被匹配网路吸收

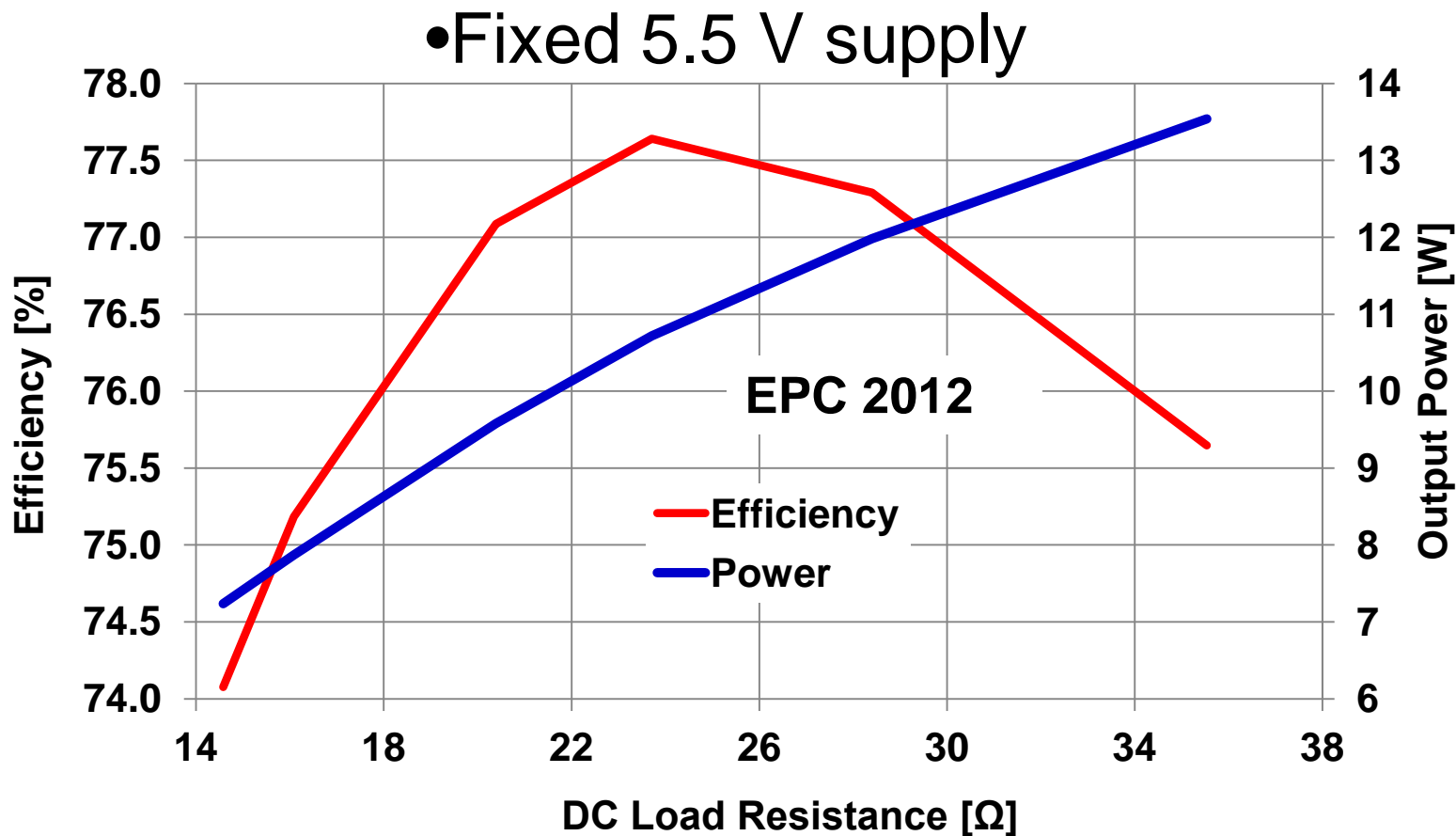


Ideal Waveforms

电流模式D类的效率

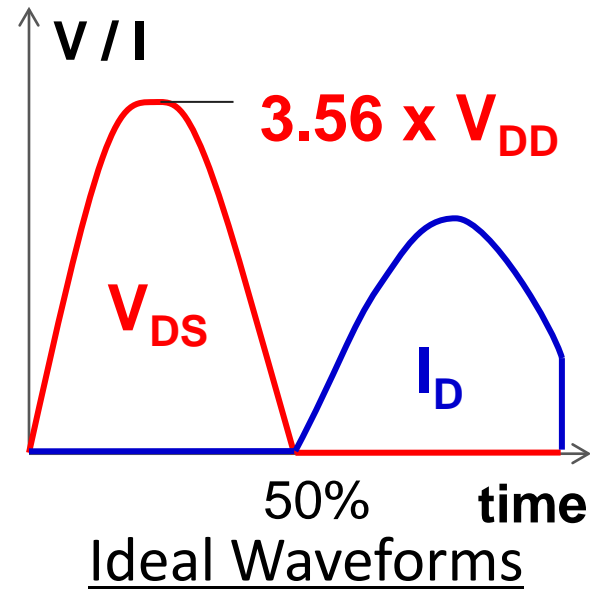
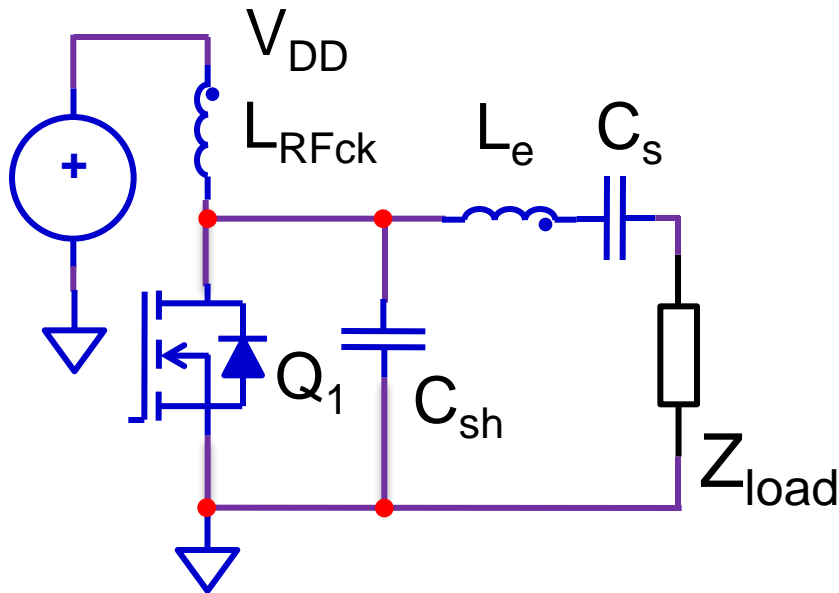


负载对电流模式D类效率的影响

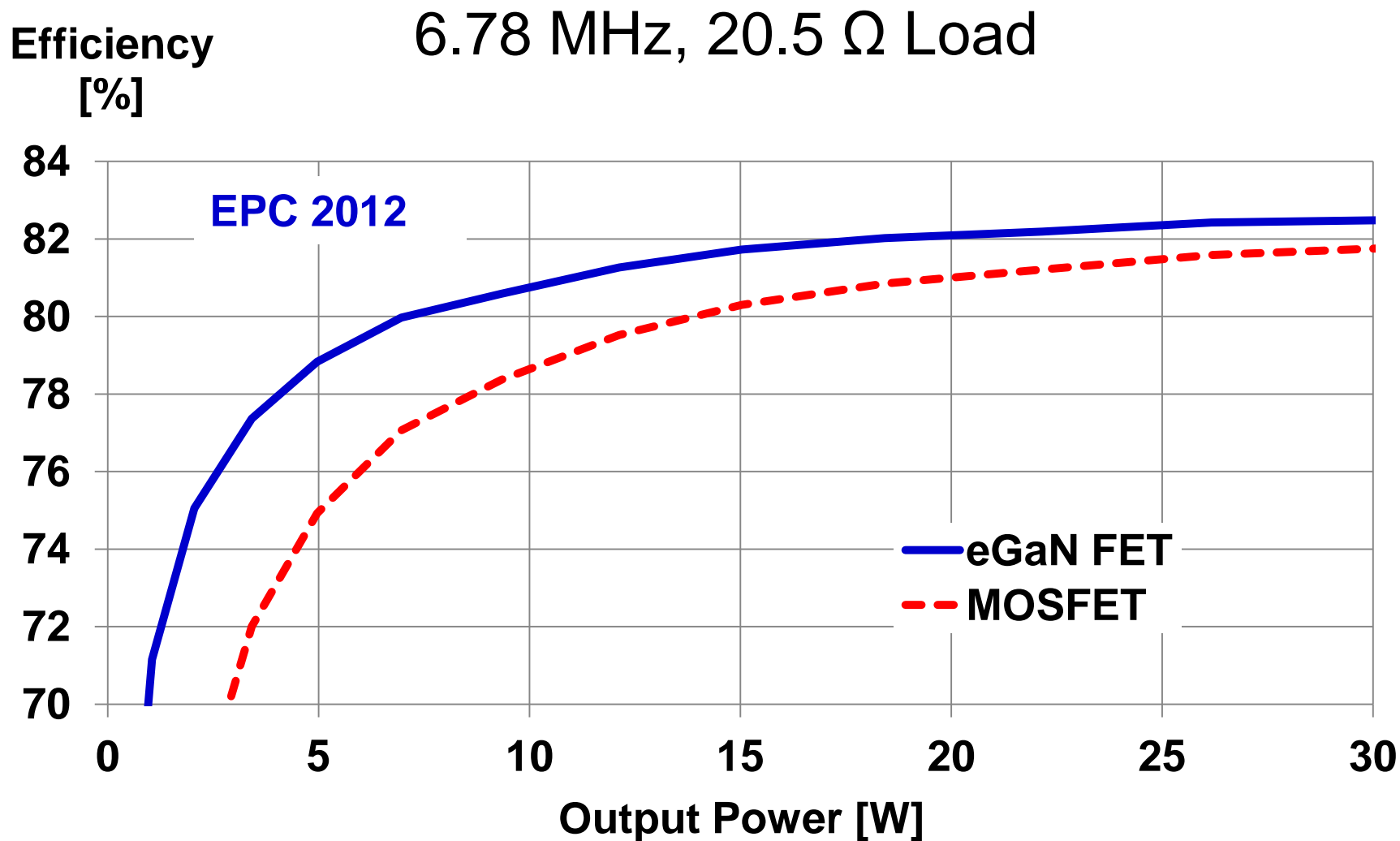


E类放大器概述

- 开关电压额定值 = 大于 $3.56 \cdot \text{Supply}$ (V_{DD})
- C_{OSS} 被匹配网路吸收

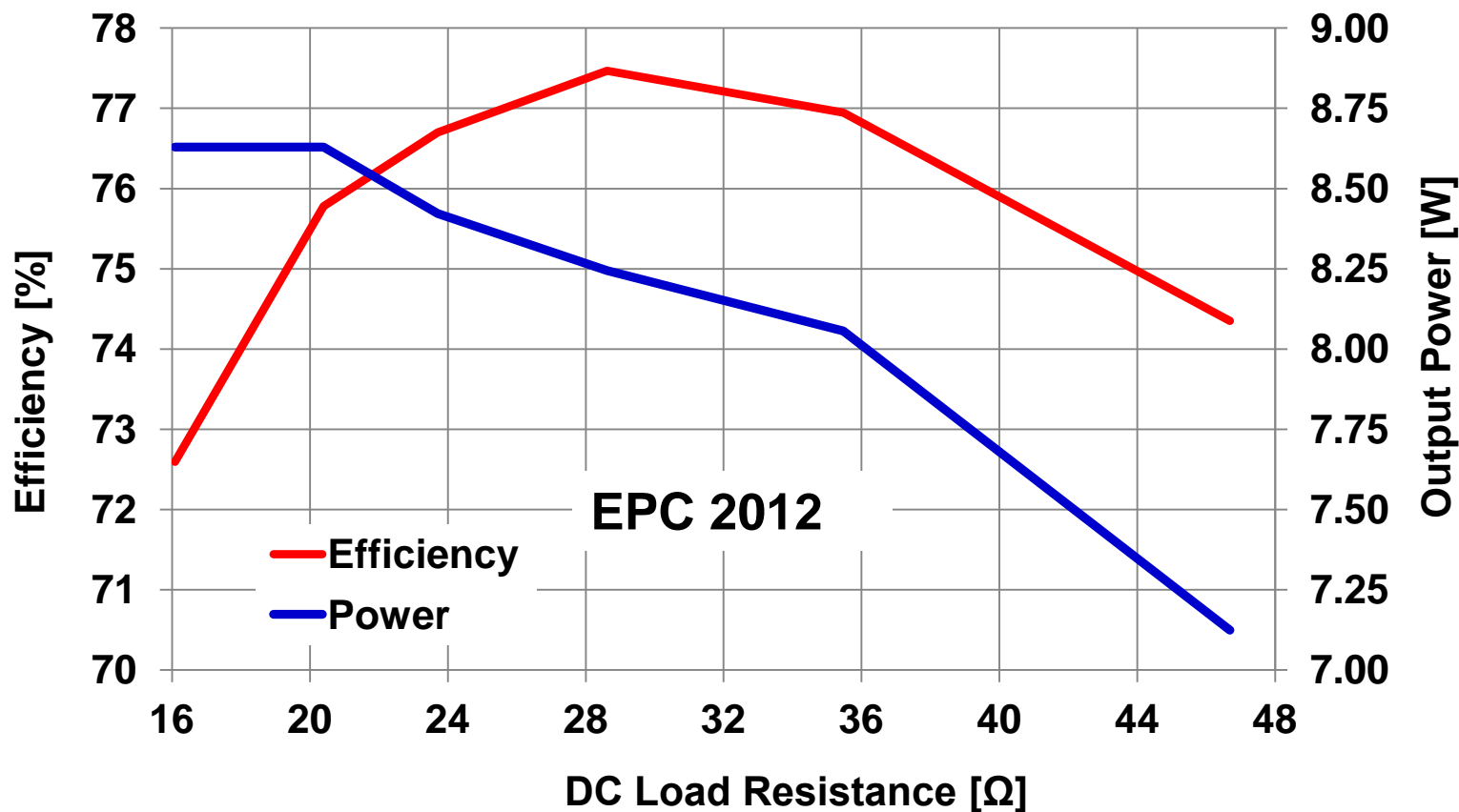


E类效率为负载的函数



负载对E类放大器效率的影响

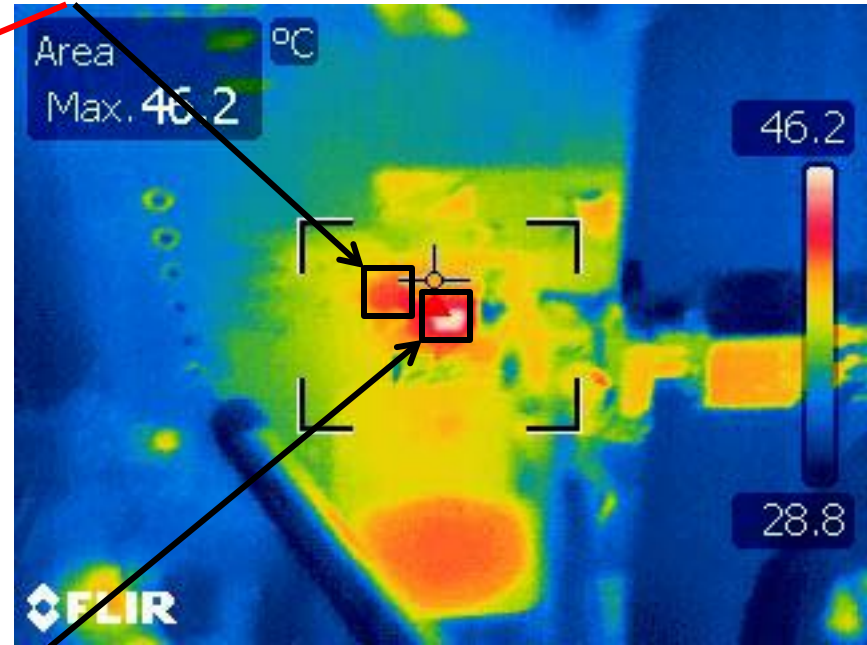
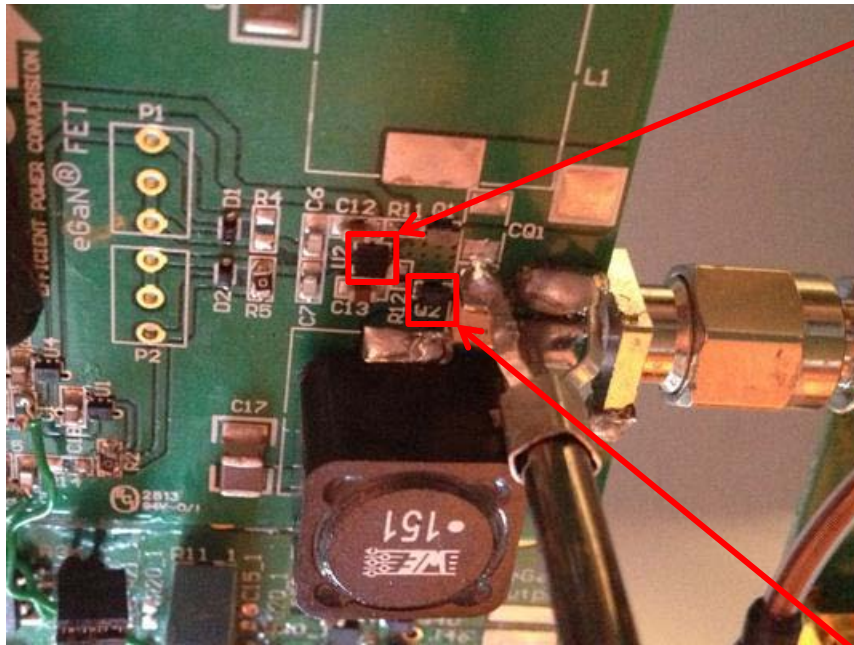
6.78 MHz, Fixed 20 V supply



E类放大器的热性能

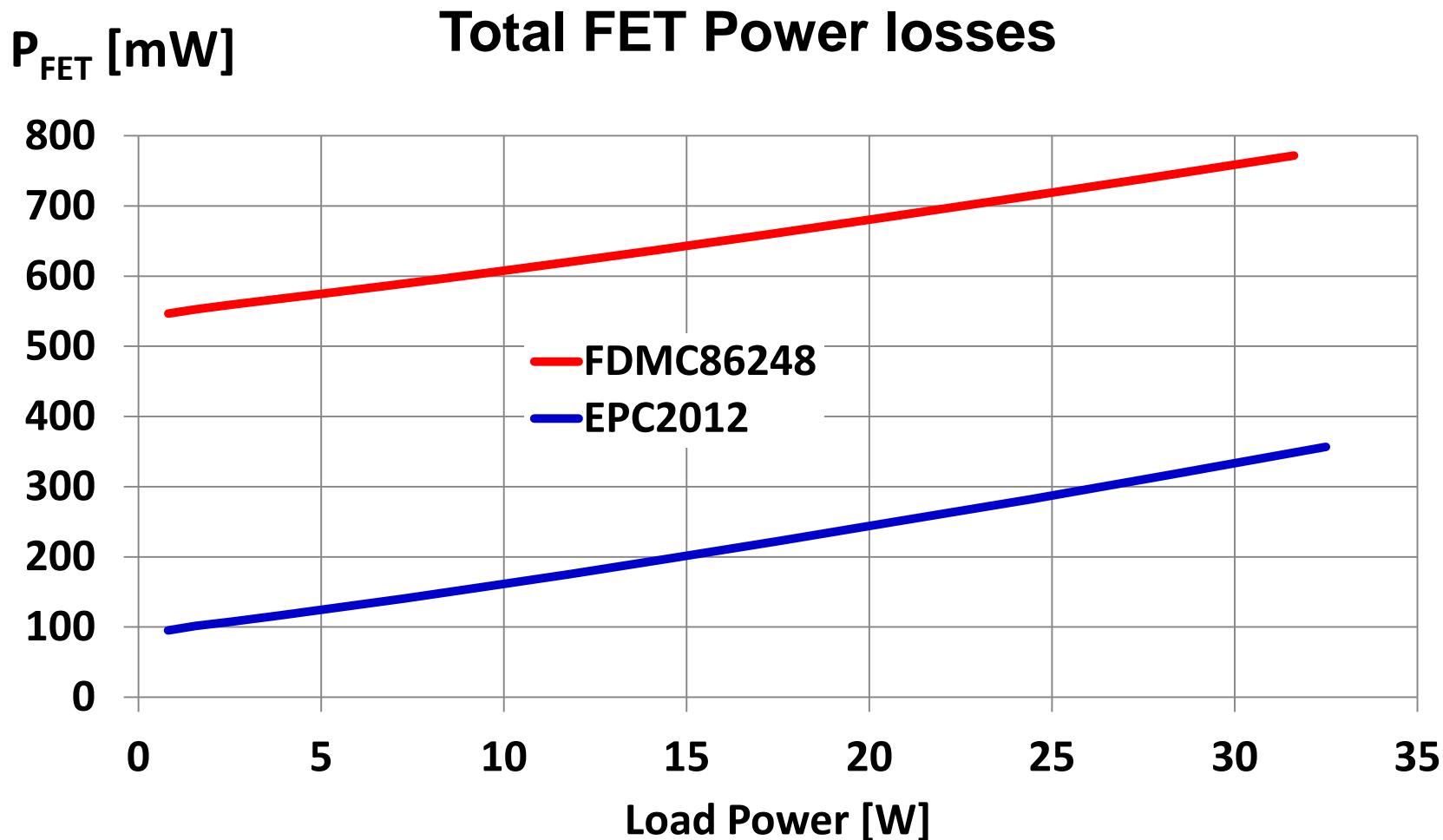
- 不需要散热器
- 30 W ， 负载为20.2 Ω

LM5113TM



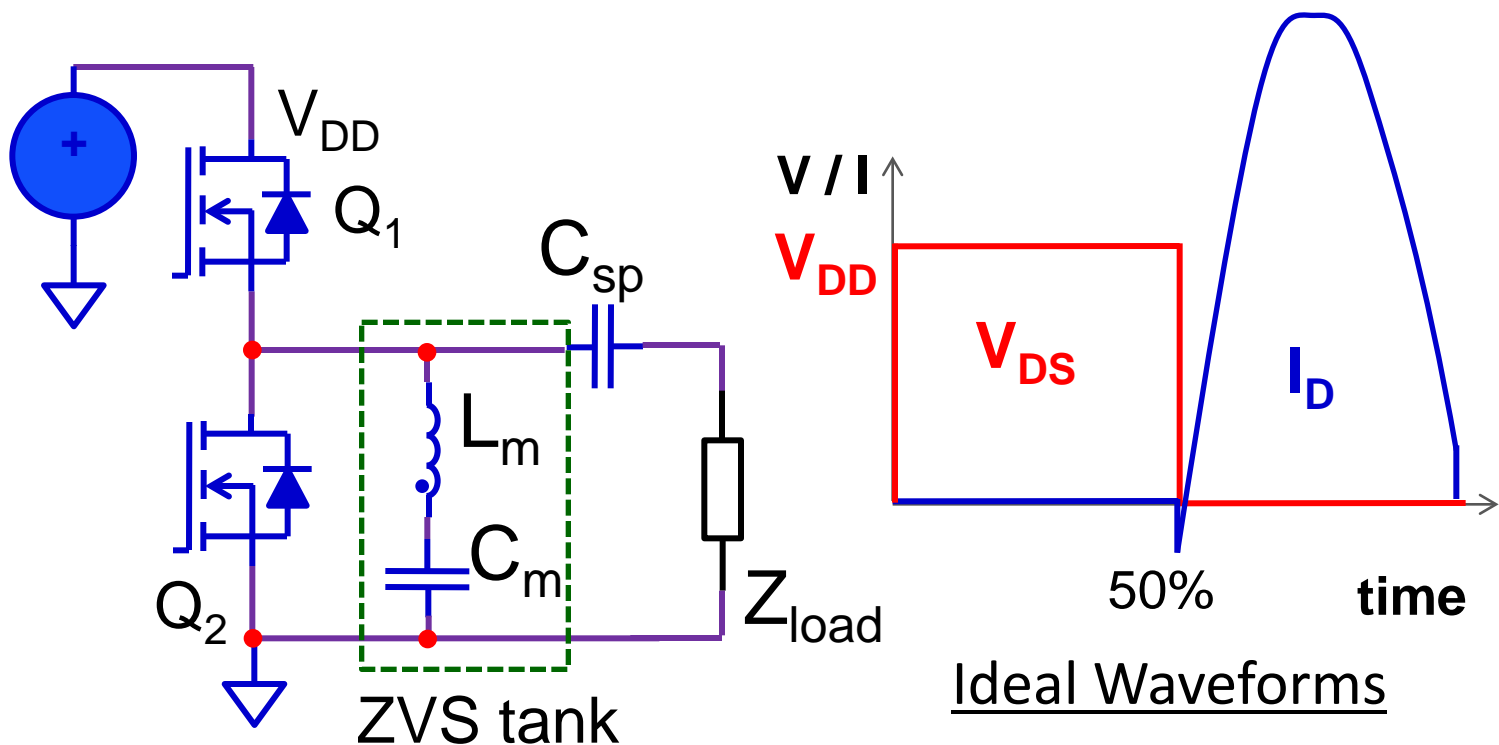
EPC2012

在E类放大器采用eGaN FET与MOSFET的总功率损耗的比较



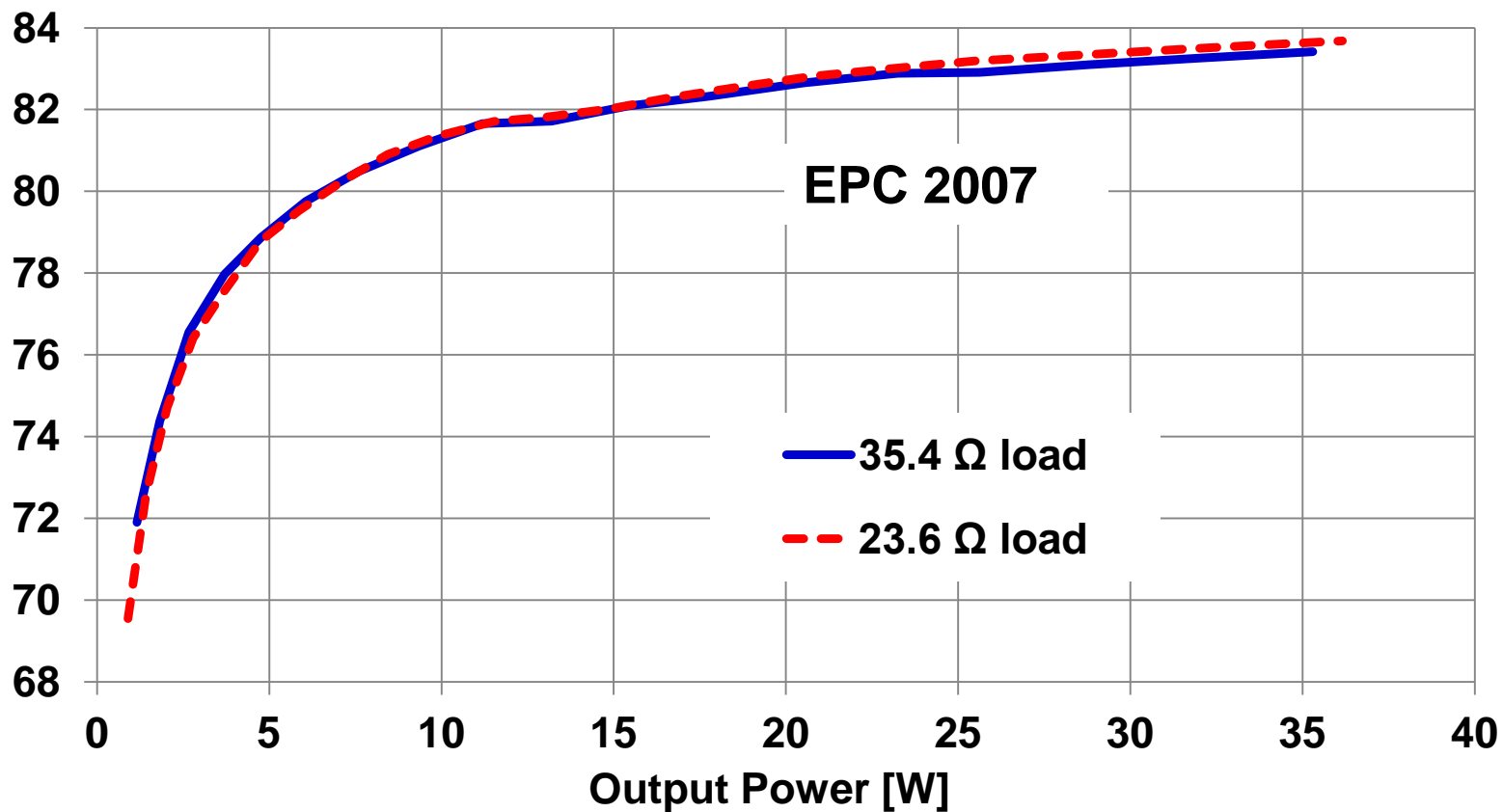
ZVS电压模式D类放大器

- ZVS 谐振电压经由 C_{OSS} 过渡
- 由于eGaN FET具较低 C_{OSS} , 因此引致较高占空比
- 可实现最高系统效率

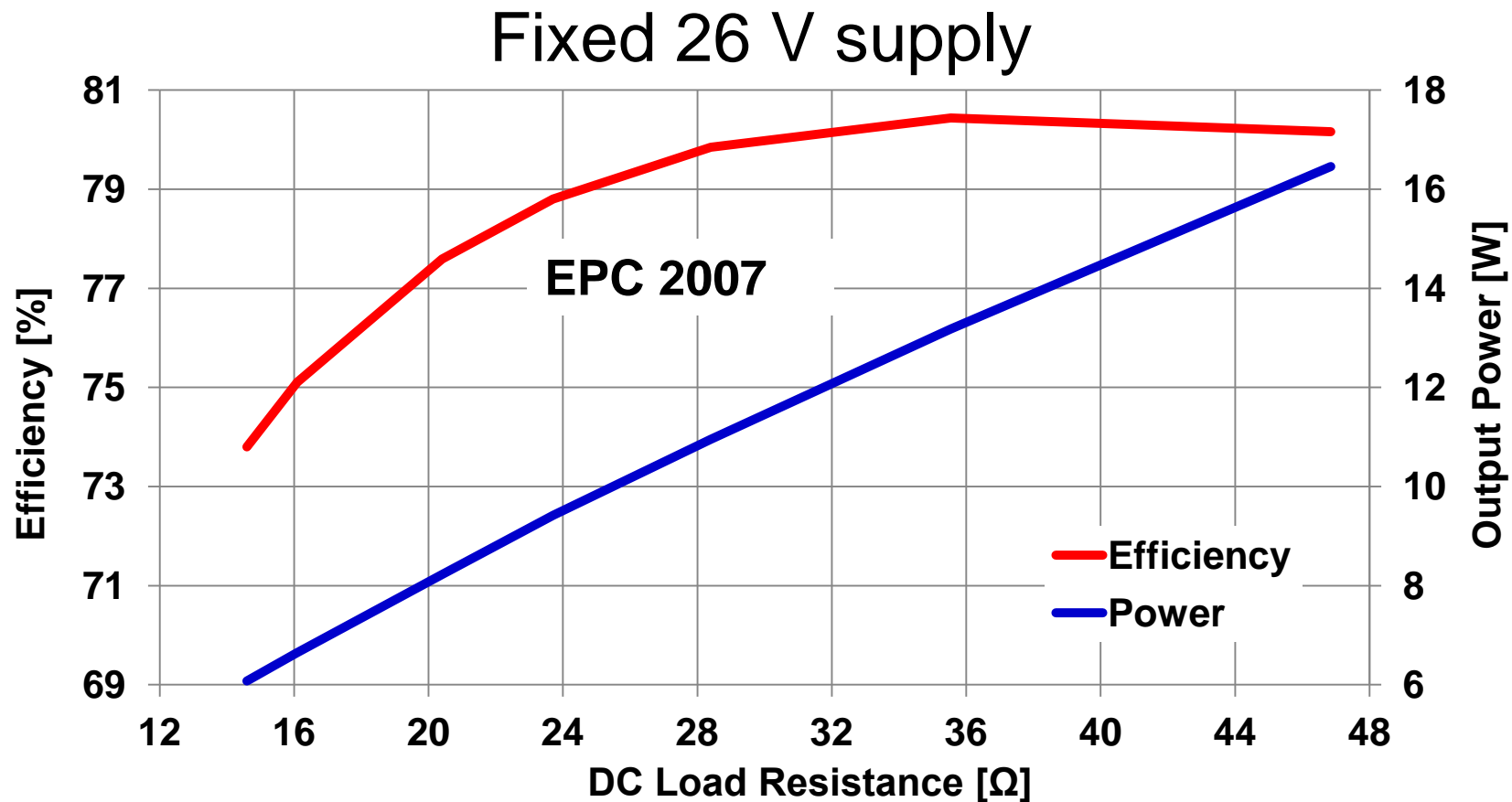


ZVS电压模式D类放大器的效率

Efficiency [%]

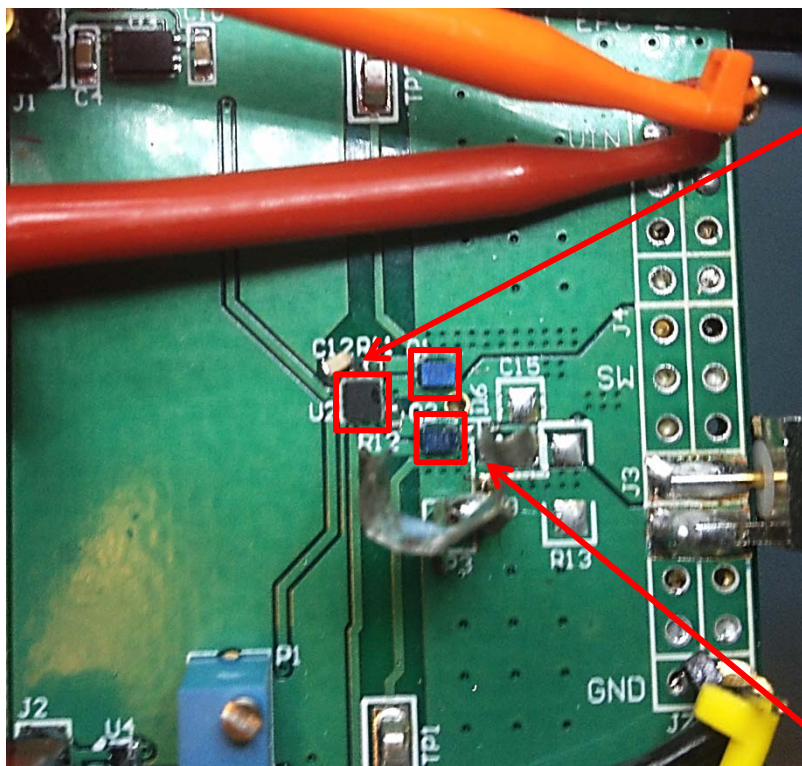


负载对ZVS电压模式D类放大器效率的影响

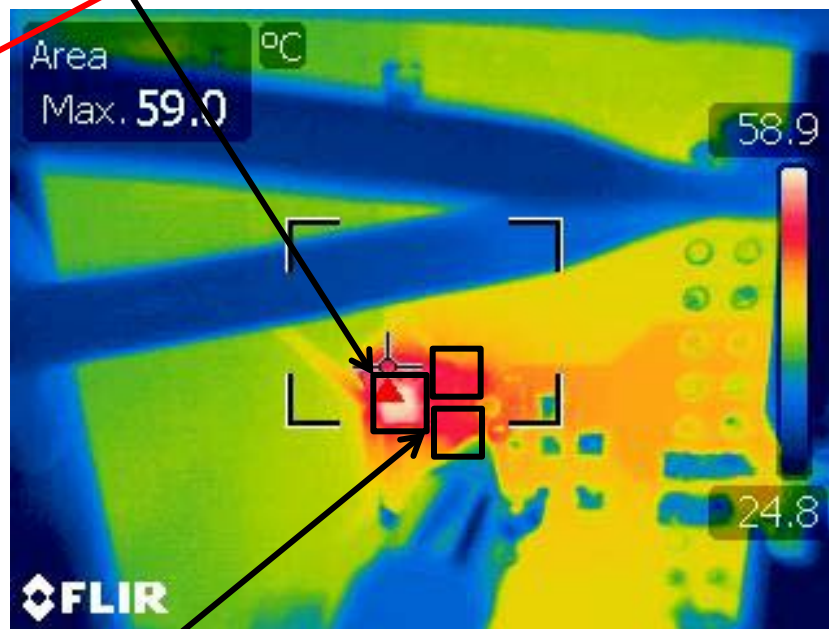


ZVS D类放大器的热性能

- 不需要散热器
- $R_{DCLoad} = 35 \Omega$, $V_{in} = 42 V$, $P_{out} = 35 W$, $f = 6.78 MHz$



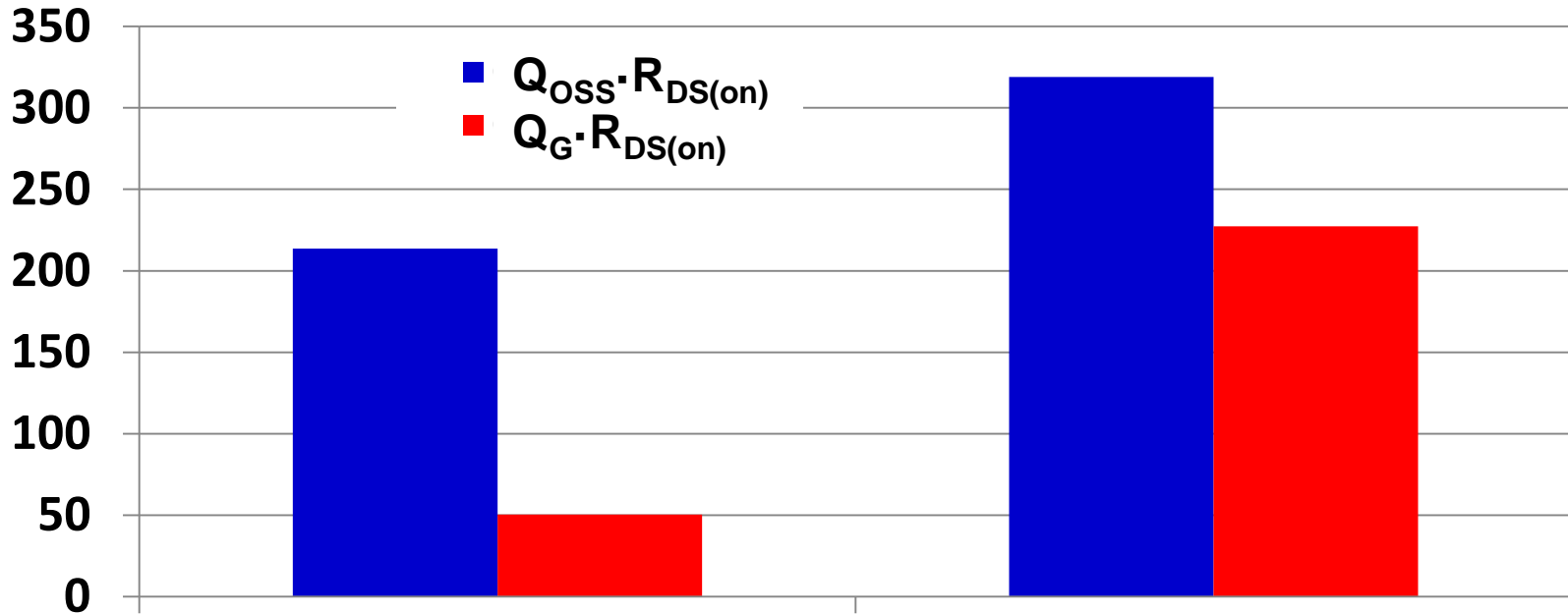
LM5113TM



EPC2007

ZVS D类放大器品质因数的比较

FOM [nC·mΩ]



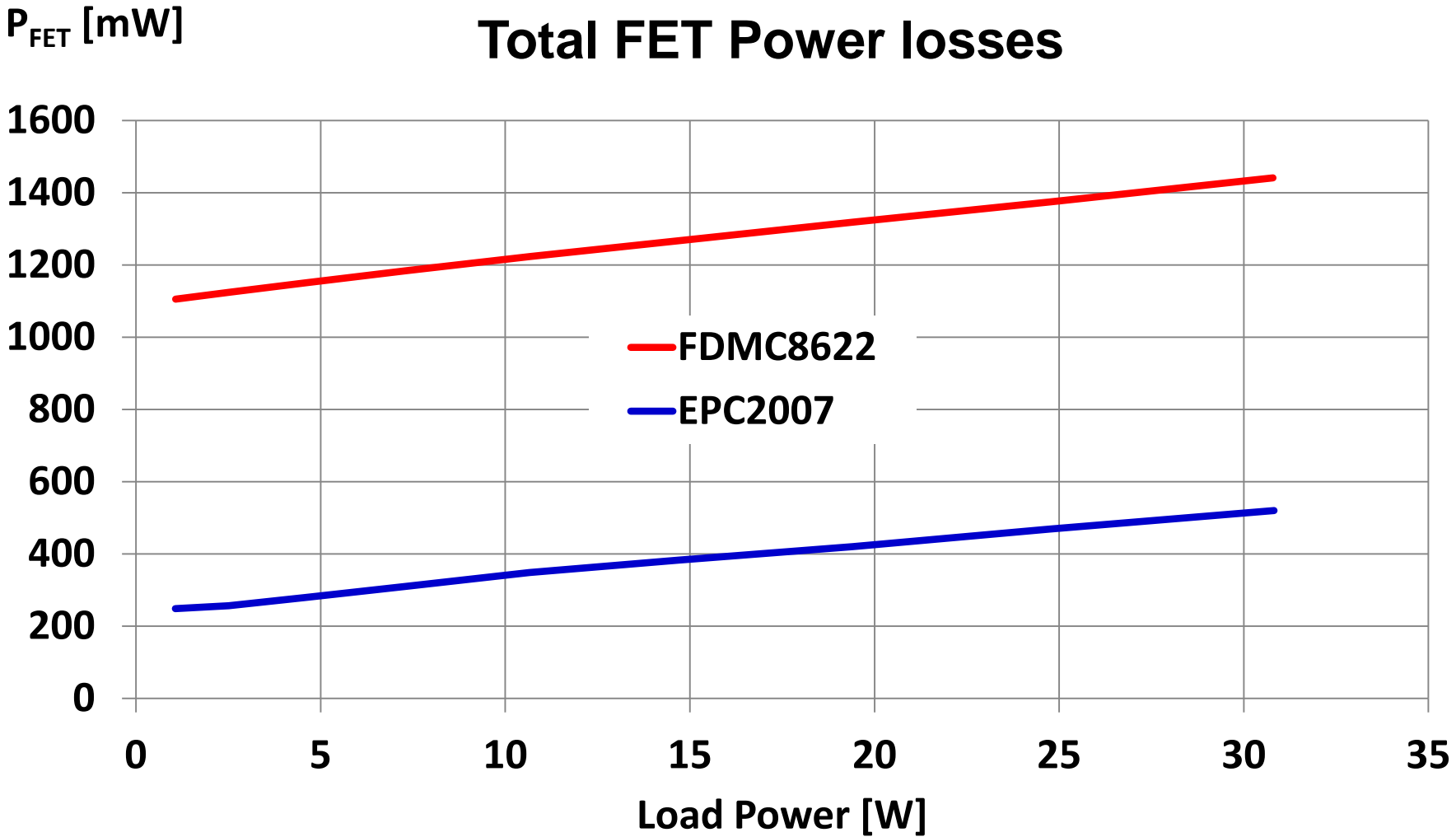
EPC2007

$BV_{DSS} = 100\text{ V}$
 $Q_{OSS} = 8.9\text{ nC at } 40\text{ V}$
 $Q_G = 2.1\text{ nC at } 5\text{ V}$
 $R_{DS(on)} = 24\text{ m}\Omega$

FDMC8622

$BV_{DSS} = 100\text{ V}$
 $Q_{OSS} = 7.3\text{ nC at } 40\text{ V}$
 $Q_G = 5.2\text{ nC at } 10\text{ V}$
 $R_{DS(on)} = 43.7\text{ m}\Omega$

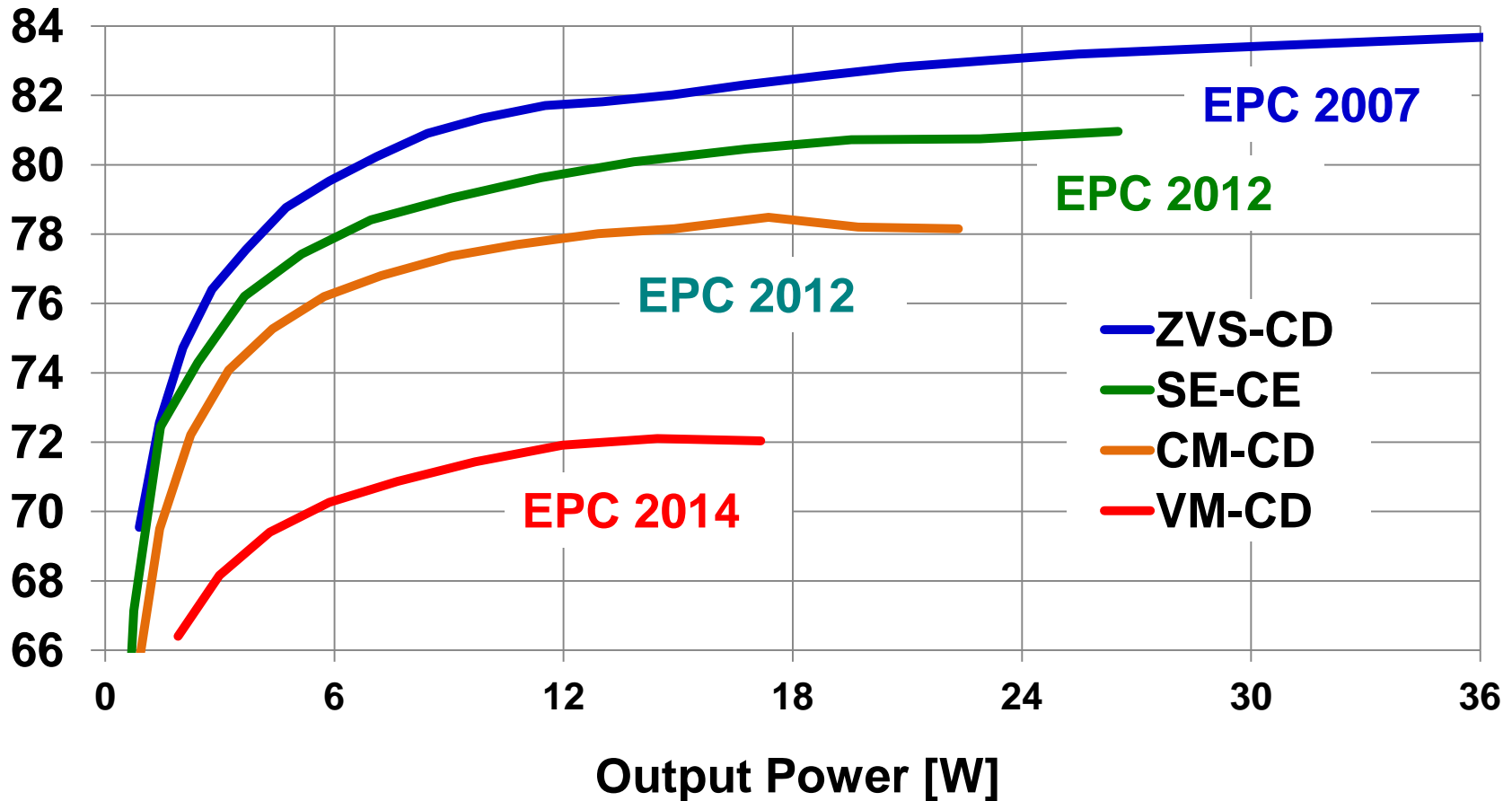
在ZVS D类放大器采用eGaN FET与MOSFET的总功率损耗的比较



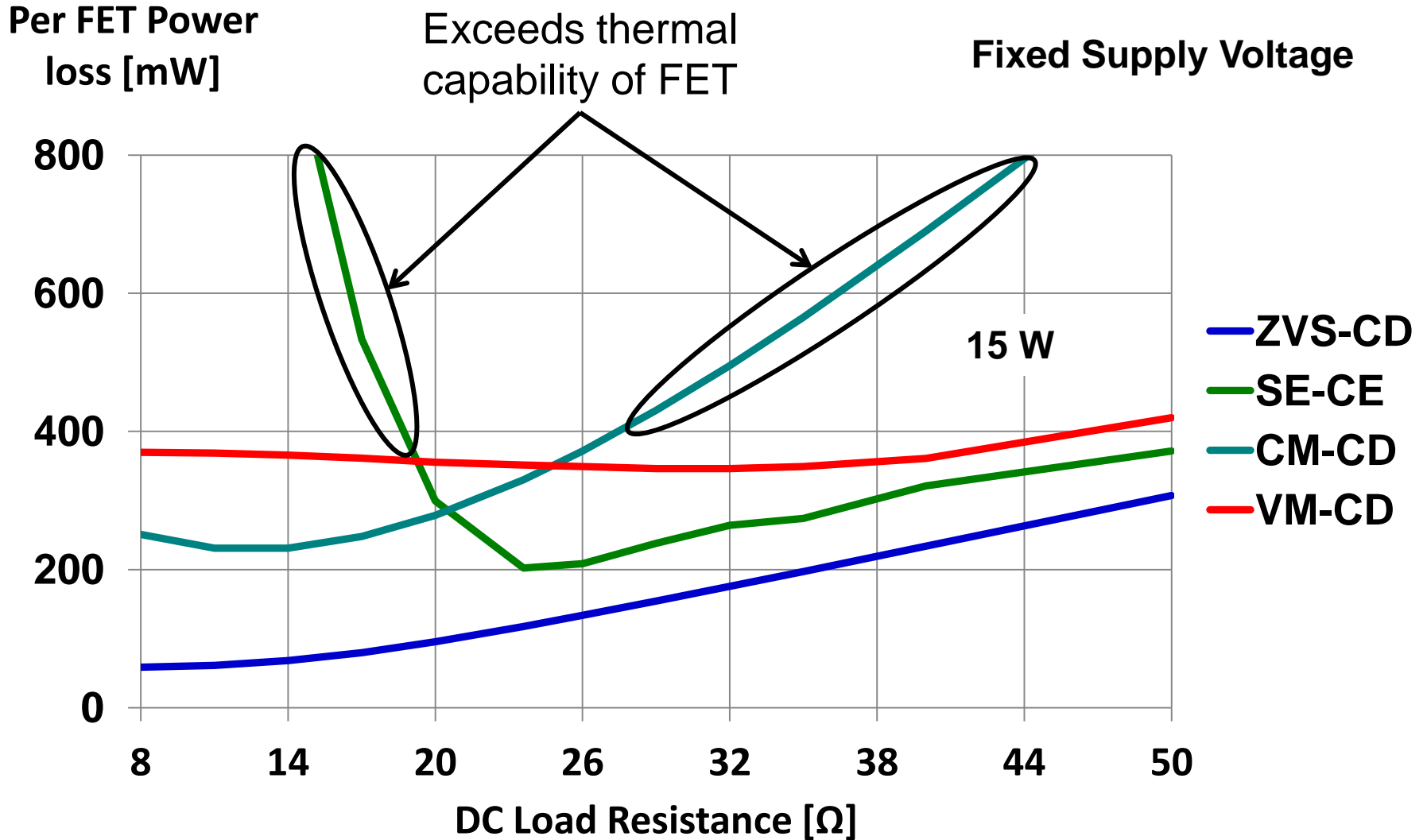
总结 - 效率结果

Efficiency [%]

6.78 MHz, 23.6 Ω Load, eGaN FET



所有拓扑的仿真场效应晶体管损耗



- 无线电源传送是目前功率晶体管业界最具发展潜力的市场
- ZVS D类放大器展示了它大有希望可为无线电源传送应用提供简单、低成本及高效的拓扑。氮化镓场效应晶体管可实现更高占空比及更高效率。
- eGaN FET在使用6.78 MHz及13.56 MHz频率的所有拓扑可实现最高效率
- eGaN[®] 技术为颠覆性创新技术



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

*is the beginning of
the eGaN FET
journey!*