Designing with GaN

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Designing with GaN

System design is key to GaN's performance

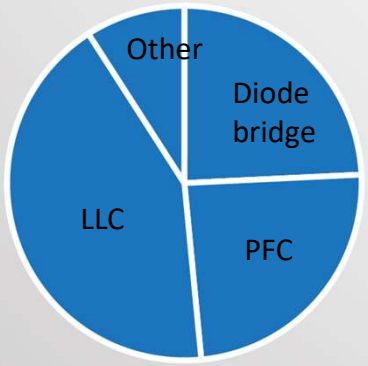
- Don't plan for drop-in replacement of Silicon transistors – you'll miss out on the advantages
- GaN's benefits enable 20% BOM savings and ≥5x volume savings

5x smaller
3x lighter
20% lower cost

Take *full* advantage of GaN – and let us help you learn how

GaN improves efficiency, losses and density

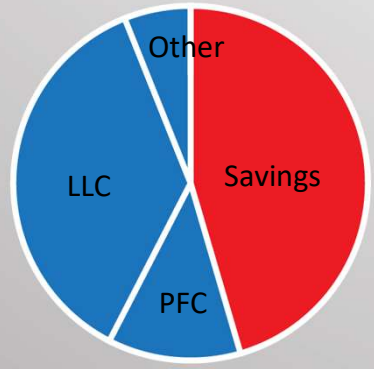
Typical 200 W AC/DC case study – where does GaN help ?



System losses

Silicon

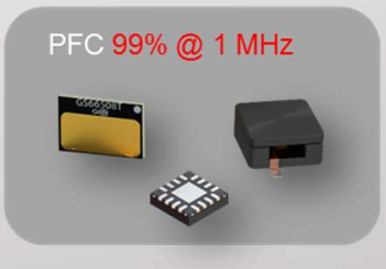
92% efficient
16.5 W losses
12 W/in^3

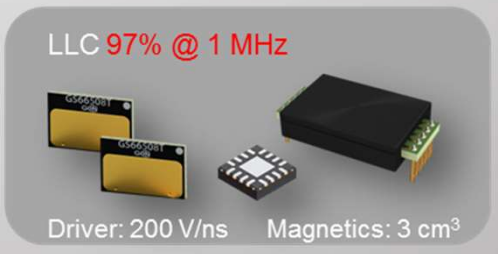


GaN

96% efficient
9 W losses
30 W/in^3

>45% loss reduction
2.5x density increase

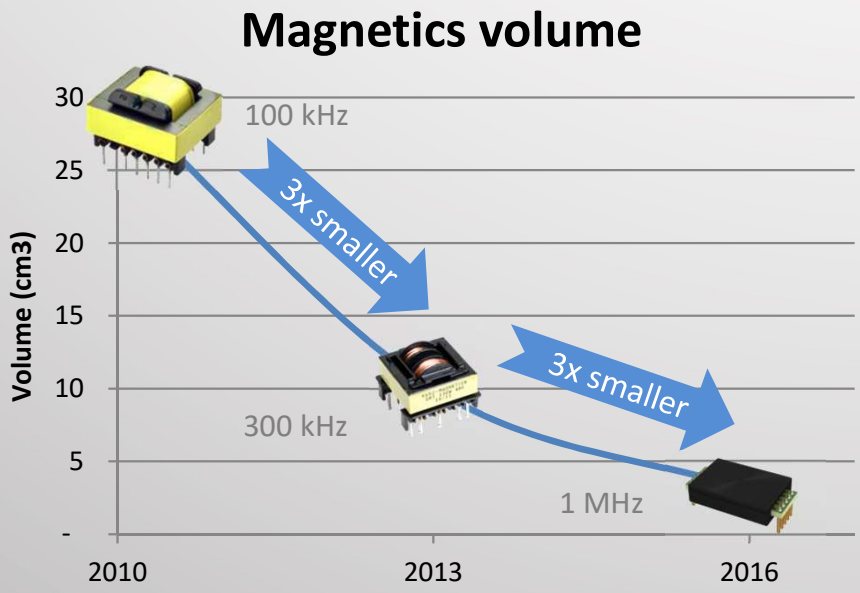


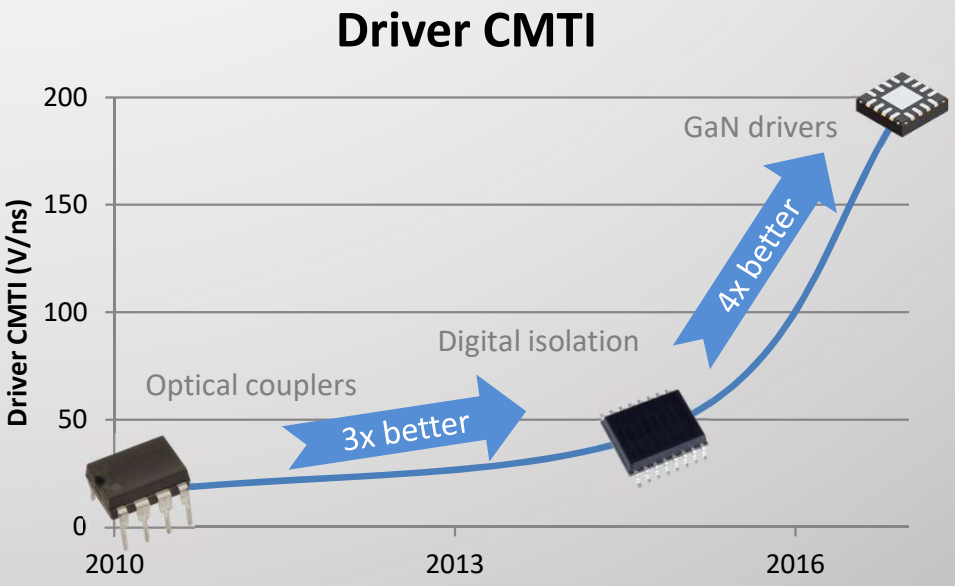


Drivers and magnetics are ready and better than ever

5 years ago, other components limited the gains using GaN …

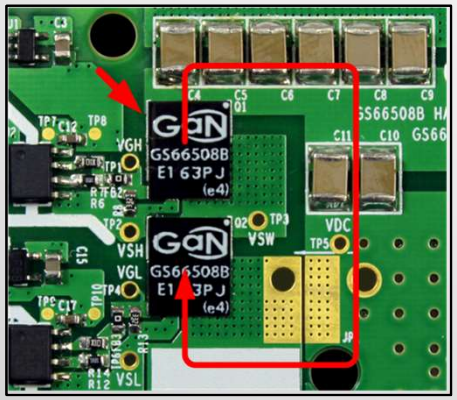
… today magnetics & drivers get the most out of very fast transistors

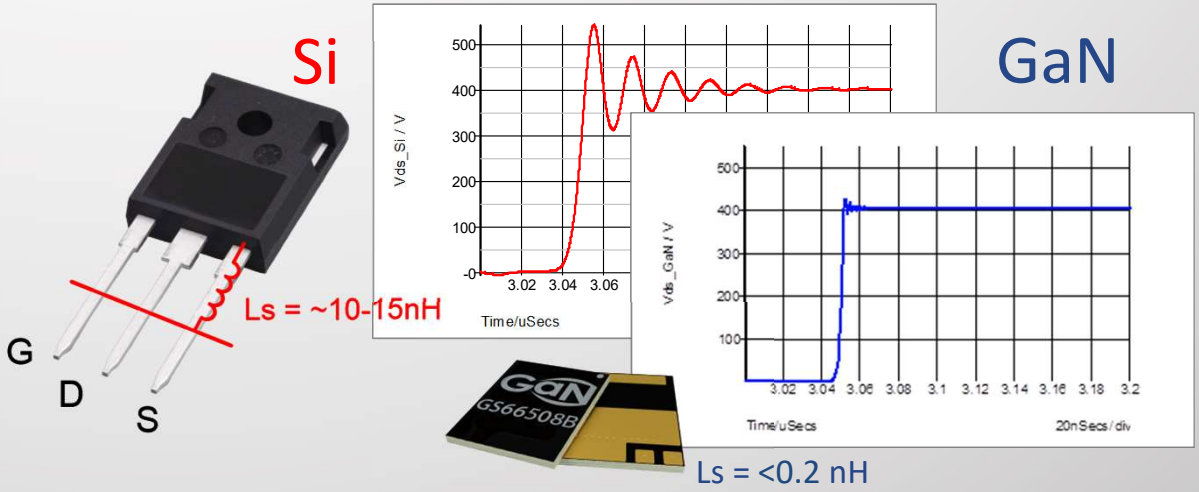




Proper layout with GaN meets EMI requirements

Some engineers wonder if increased switching speed results in higher EMI …
… but GaN actually enables easier EMI management in 4 key ways





1 - Smaller packaging and magnetics lead to tighter layout, which reduces power loop area and radiative emissions

2 - Shorter package leads mean smaller parasitics and less ringing, which reduces both radiative and conductive emissions

Proper layout with GaN meets EMI requirements

CM EMI example (CoolMOS vs GaN)

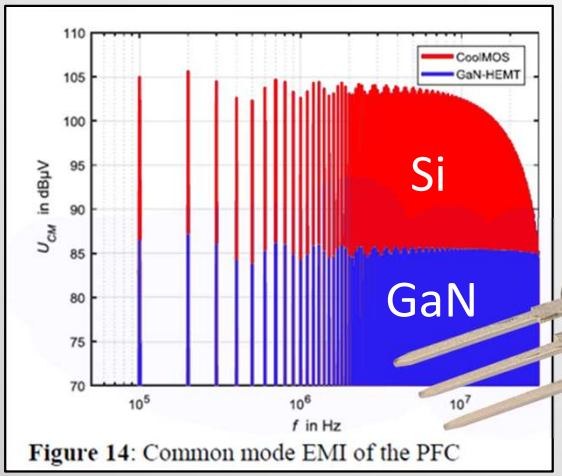
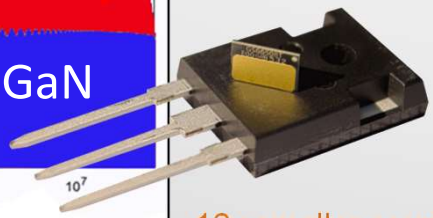
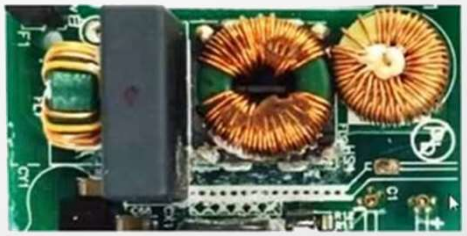


Figure 14: Common mode EMI of the PFC

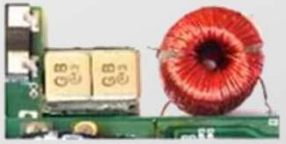


16x smaller coupling area



<100 kHz
60 W
7 W/in^3

>1 MHz
65 W
30 W/in^3



4x smaller

3 - No heatsinks & smaller packages reduce coupling, generating less common mode noise

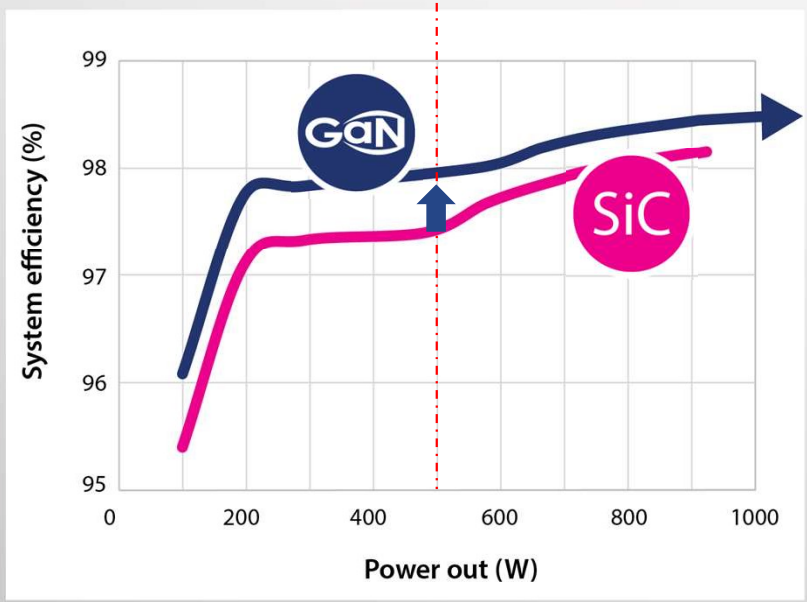
4 - High frequency energy is easier to filter and uses smaller filters

Source: A.Bendicks, EMI, Losses and Cooling of Low-Inductance GaN-HEMTs in a CCM PFC of an On-Board Charger

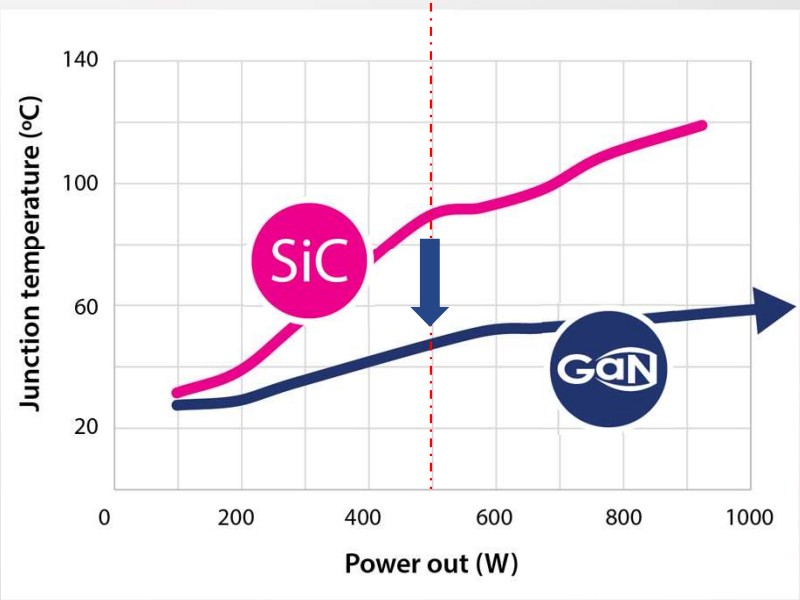
Design … putting it all together

Synchronous buck DC/DC system (400-200 V, 200 kHz, T_{amb}=25ºC)

0.6% more efficient



60˚C cooler



GaN's more efficient = higher density

GaN runs cooler = increased reliability

Source: J. Xu, et al, Performance Comparison between GaN E-HEMT and SiC MOSFET in Power Switching Applications, 2017

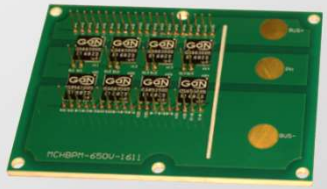
Achieving great results with GaN

GaN + good design = 5x system improvement

- Design and layout are important
- The drivers and magnetics you need are ready and better than ever
- Proper layout with GaN meets EMI requirements

GaN Systems'
Plug and play solutions

Half bridge power stage



IMS board maximizes power

Half bridge with driver power module

3 kW bridgeless totem pole PFC