The GaN journey begins...

Agenda

- Intro to EPC
- Why it's the end of the line for silicon in high frequency power conversion
- Why GaN?
- Overview of EPC *eGaN* technology
- Applications Examples
- EPC's product offering

Mission and Purpose

We enable the most efficient energy conversion using superior semiconductor materials

EPC designs, develops, markets, and sells Gallium Nitride based power management devices

Background for the Strategy

- **Silicon has reached performance limits in power management**

- **New materials now enable a game-changing price/performance ratio**

Why Gallium Nitride?

- **GaN offers superior performance compared with both silicon and silicon carbide**
  - *R_{DSON} x Area*
  - *Very high switching speed*
  - *Body Diode has no Q_{RR}*
  - *High Voltage Capability at low $R_{DS(ON)}$*

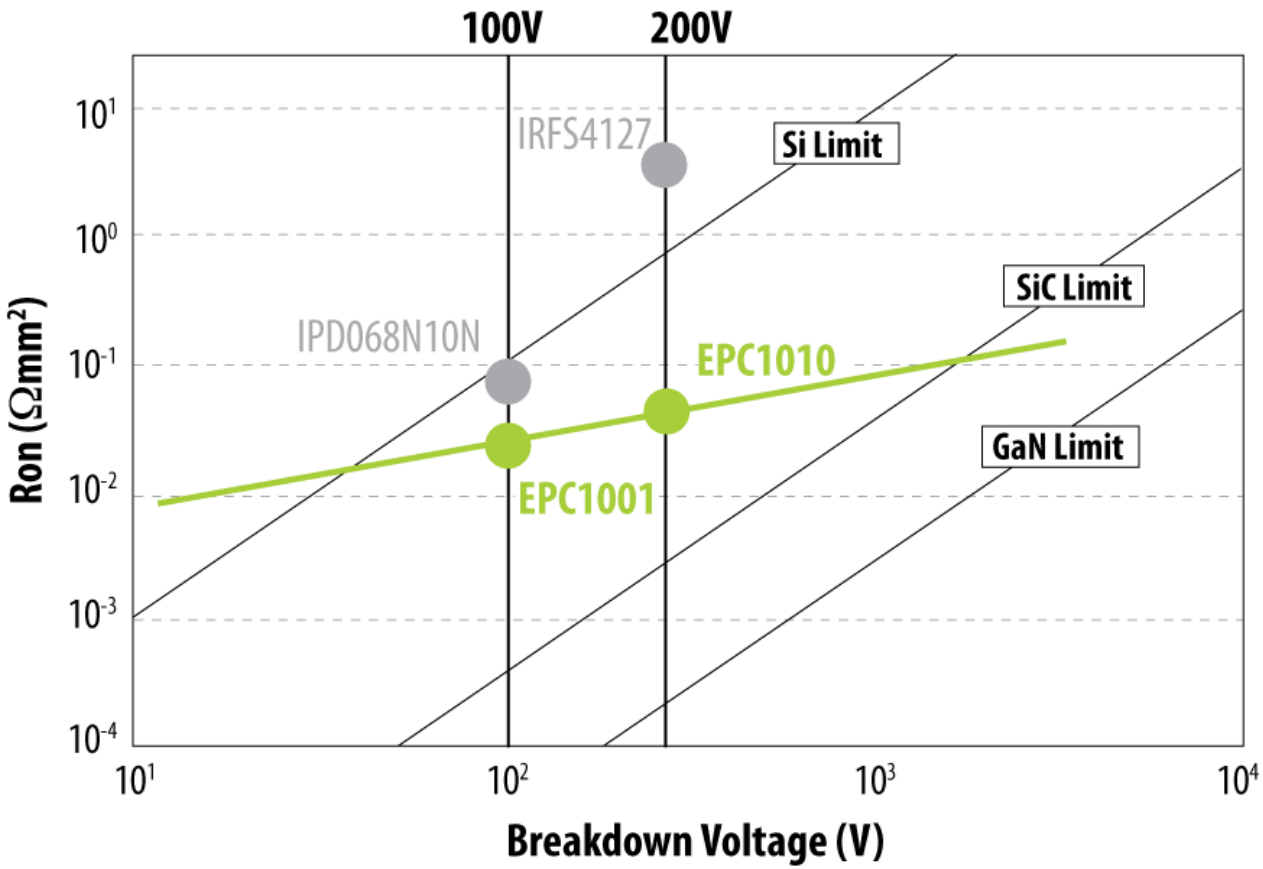
Why Gallium Nitride?

- **Device-grade gallium nitride can be grown on top of silicon wafers and processed in standard CMOS facilities**
- **GaN-on-silicon offers the advantage of self-isolation and therefore efficient power devices can now be made monolithically**
- **EPC has developed proprietary technology for the first *enhancement-mode* devices (eGaN) to be offered on the market!**

Why eGaN?

Smaller Die Sizes

The on-resistance ($R_{DS(ON)}$) for a given device area is a key determinant of product cost.



Why eGaN?

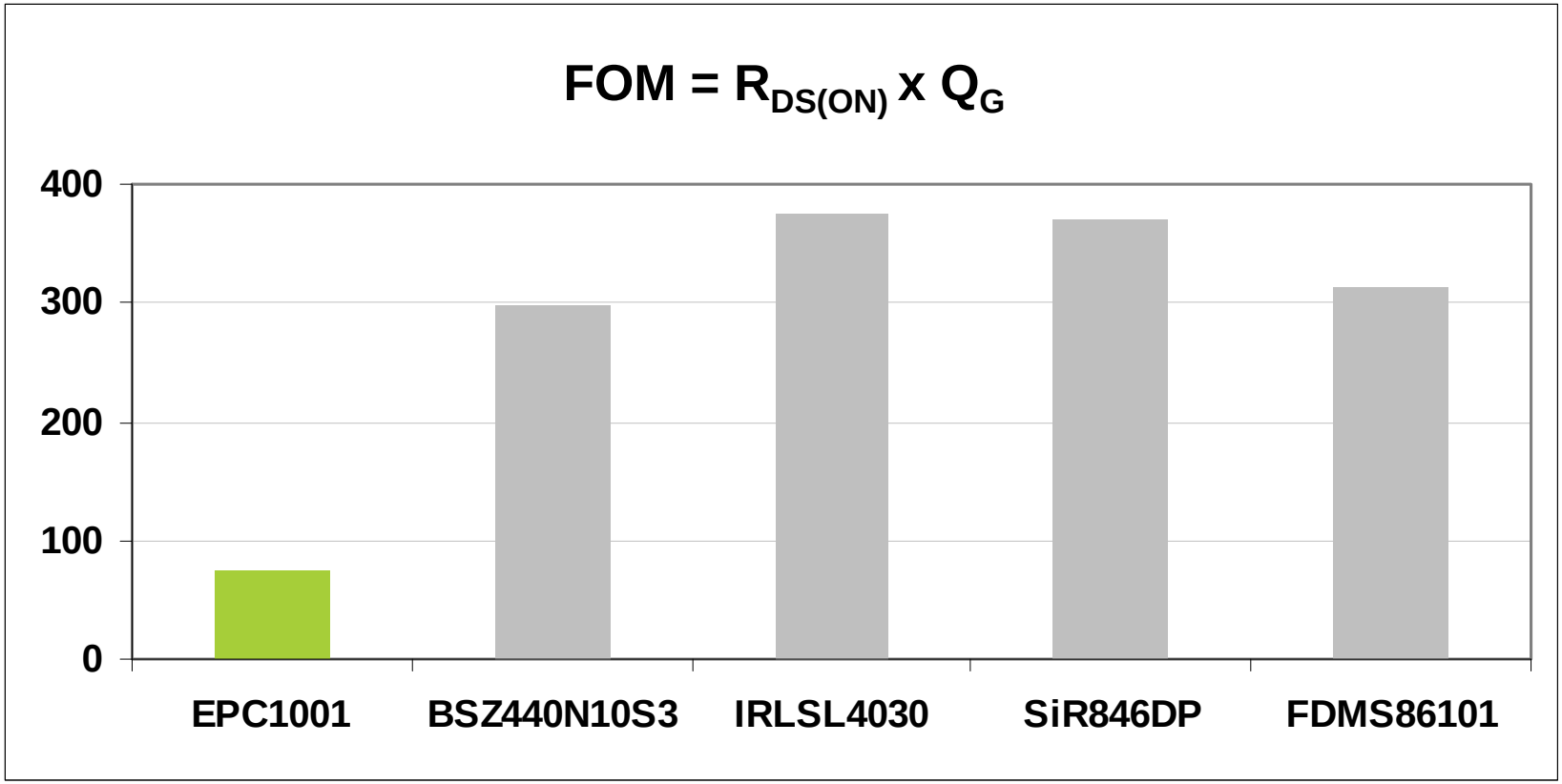
Smaller Die Sizes

EPC's products have the same on-resistance and are significantly smaller than the best silicon parts available.

200V Silicon Device (30 mΩ)

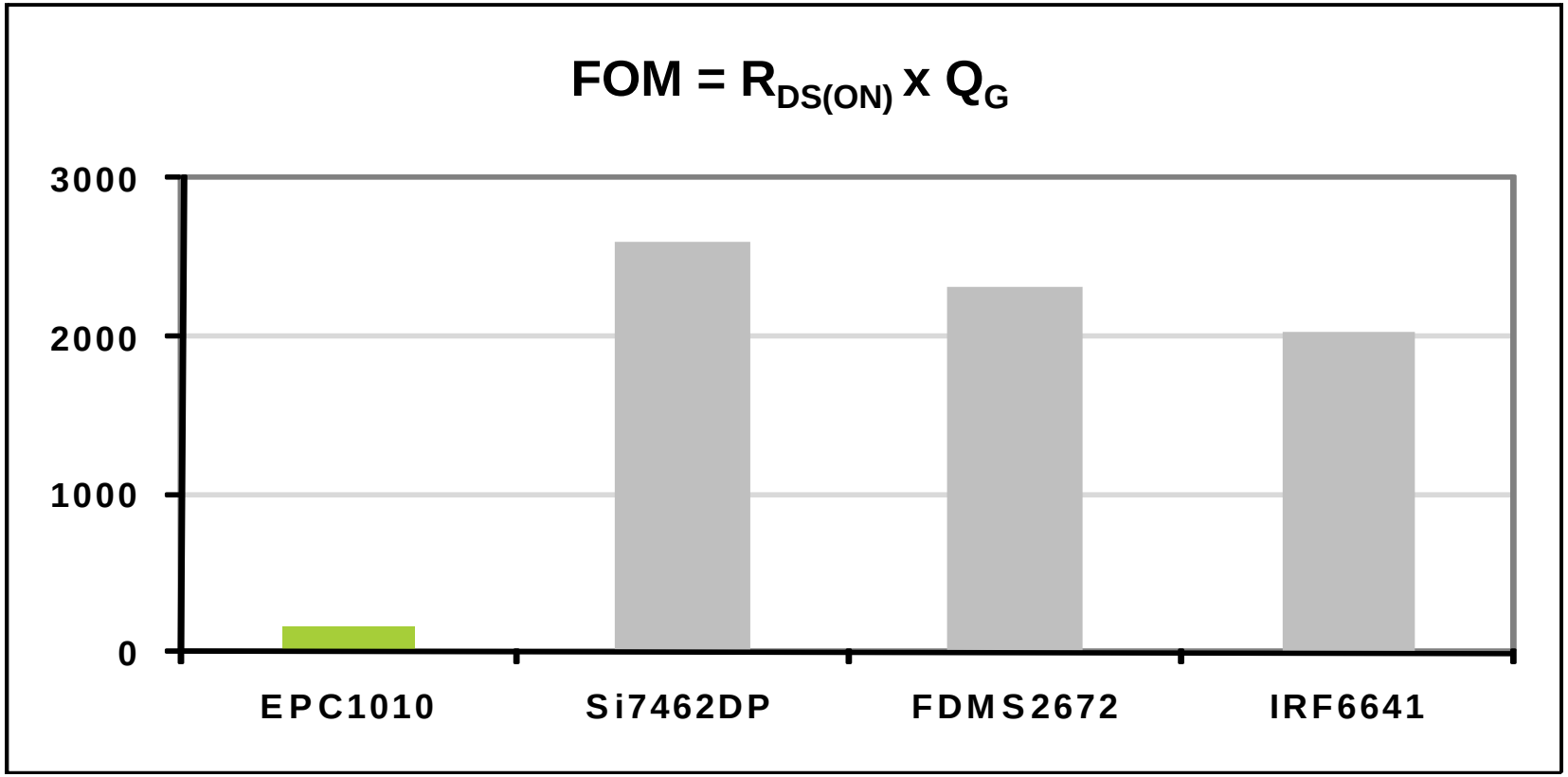
200V eGaN Device (25 mΩ)

100 V Figure of Merit



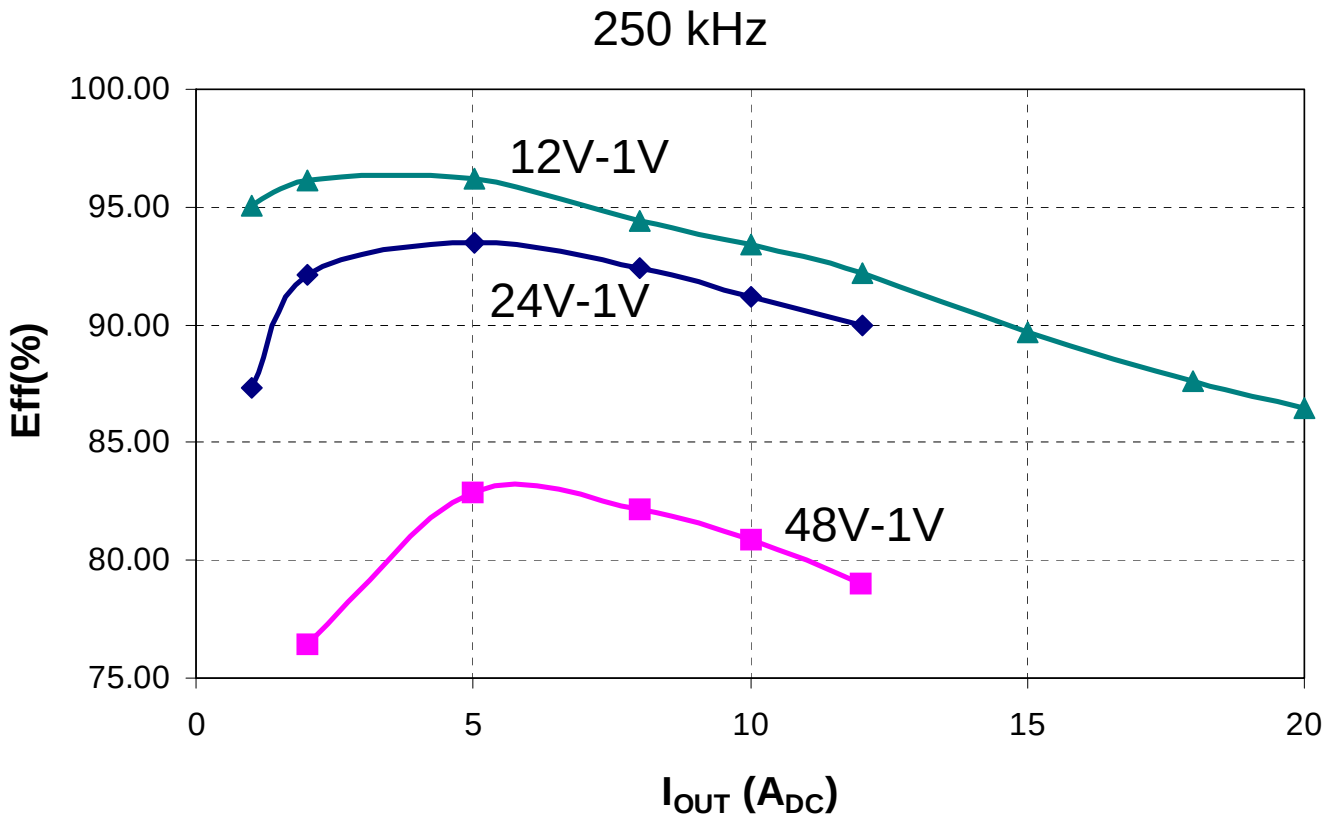
eGaN can enable applications beyond the range of silicon

200 V Figure of Merit



eGaN can enable applications beyond the range of silicon

Converter Efficiency



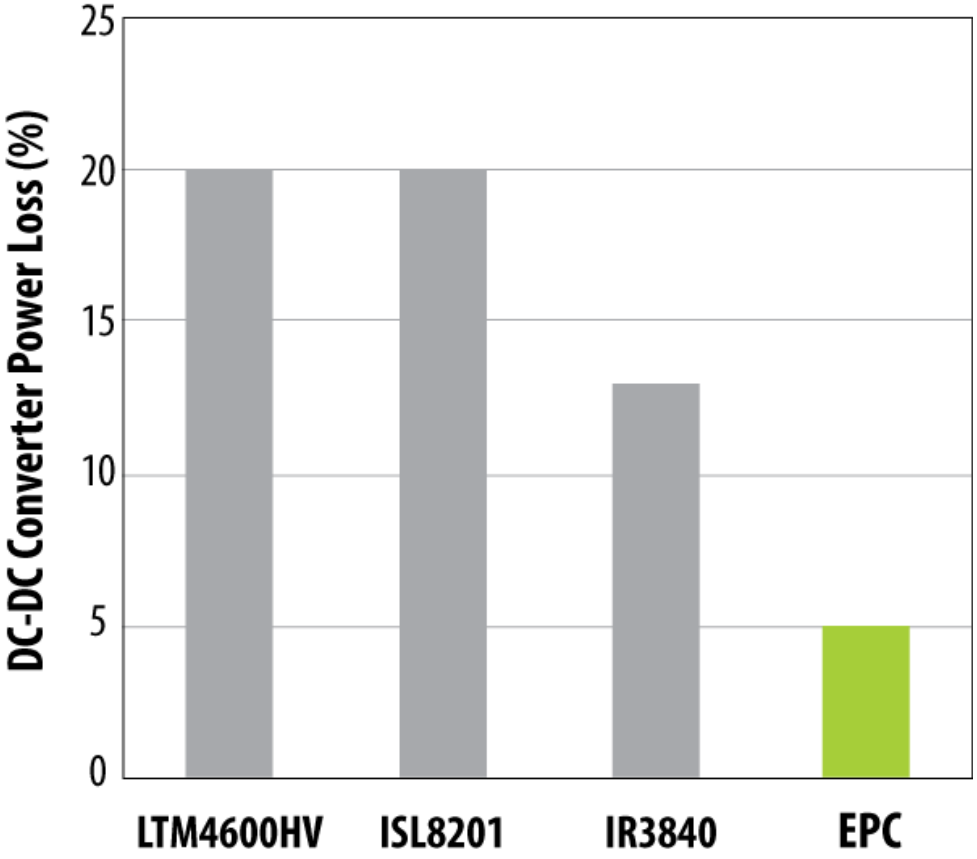
eGaN can enable applications beyond the range of silicon

Why eGaN?

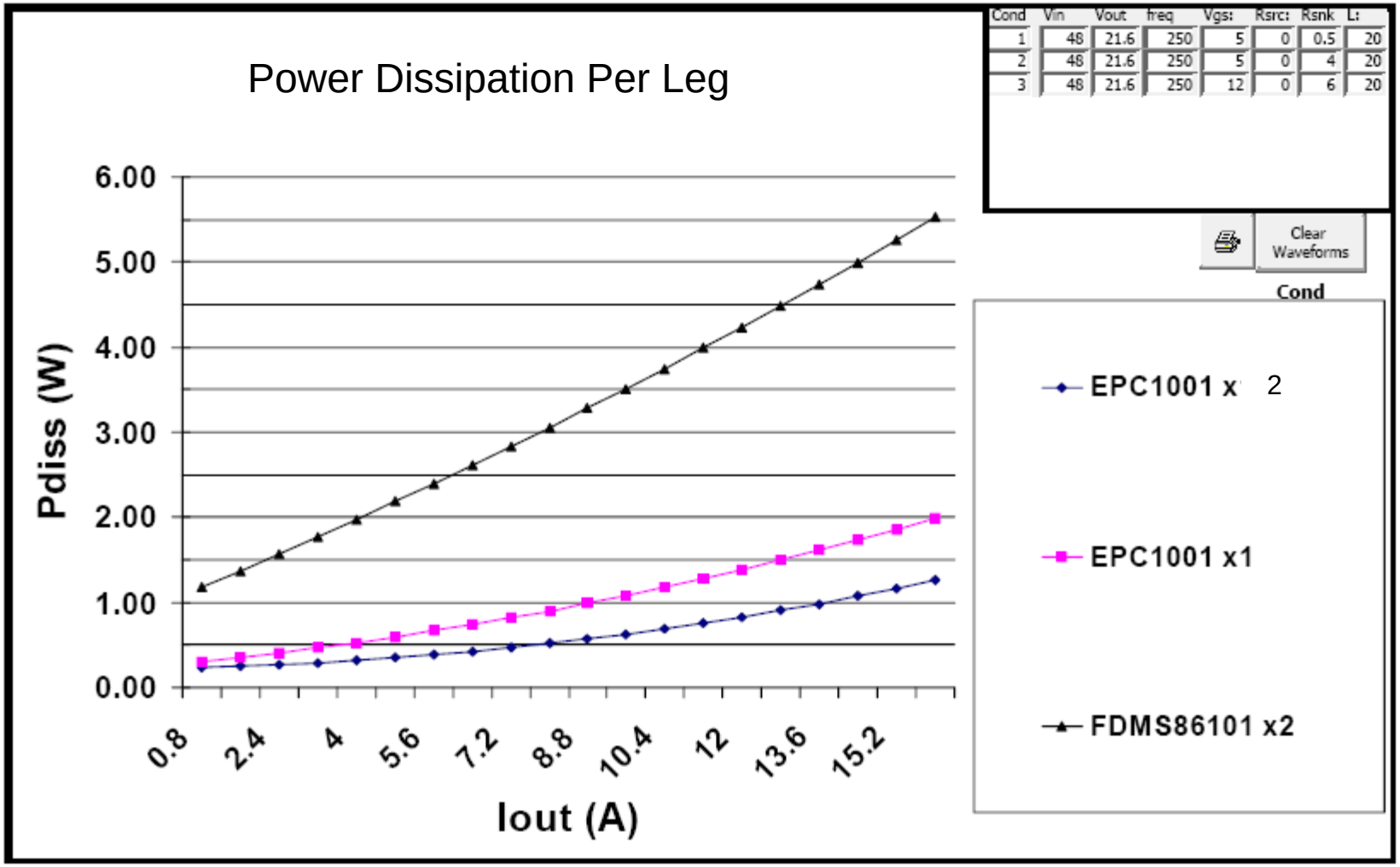
Lowest Power Losses

DC-DC converters using EPC's eGaN transistors have power losses that are more than 50% less than the closest competitive solution

12V-1V 5A 600kHz conversion

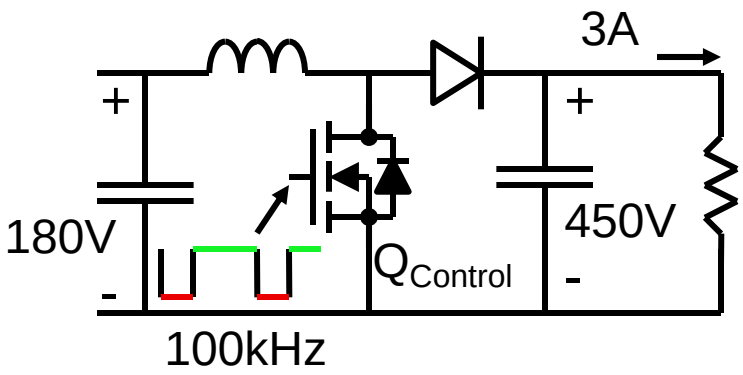


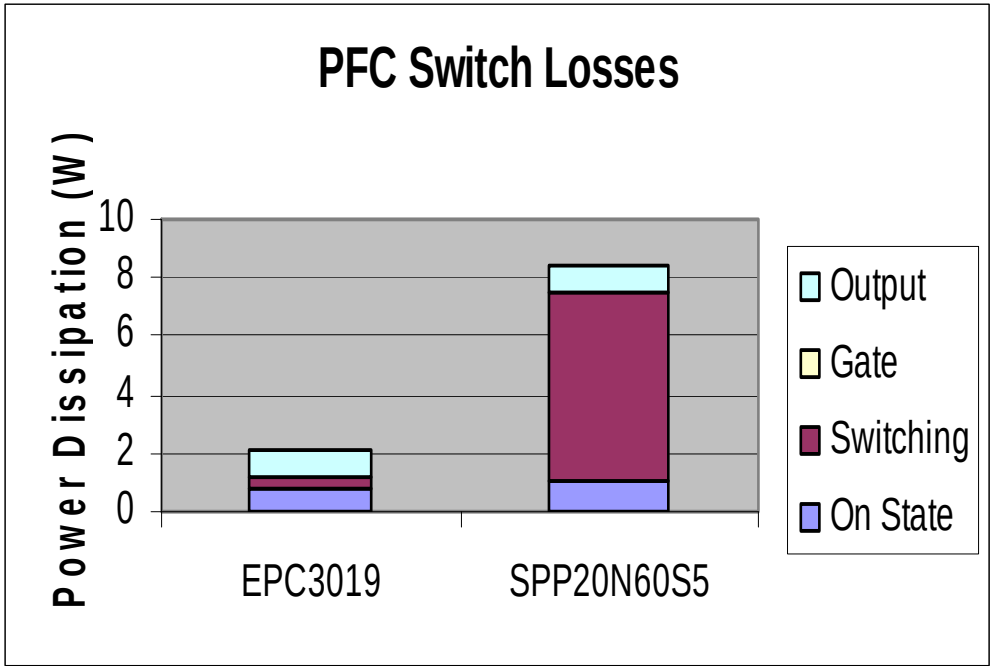
POE – 12 A
Full Bridge



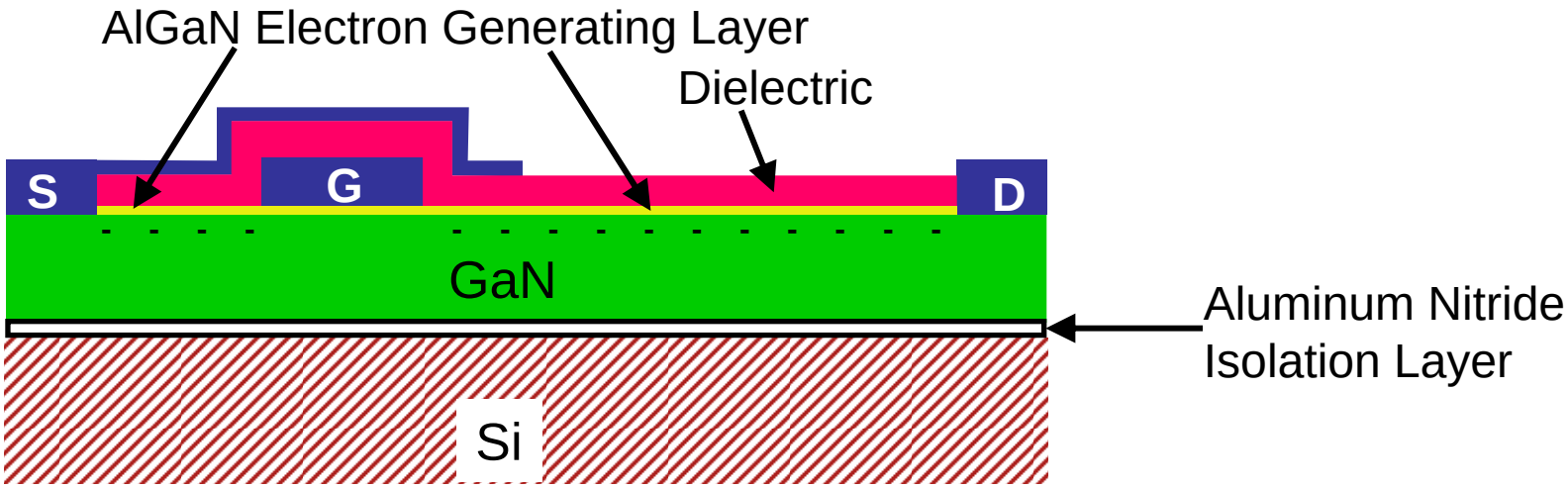
Hard Switched PFC

Part Number	Package	Mode Ch	Configuration	Vds	Vgs	Rdson (mΩ) 5V	Rdson (mΩ) 100C	Q5 (nC)	Qgs (nC)	Qgd (nC)	Vgth (V)	Rg (Ω)	Qrr (nC)	Qoss (nC)	Id (A)	FOM (RxQ)
Add Manufacturer																
EPC3019																
EPC3019	SON 5x6	EN	Single	600	6	106		7.1	0.526	4	1.4	5	0	28	5	753

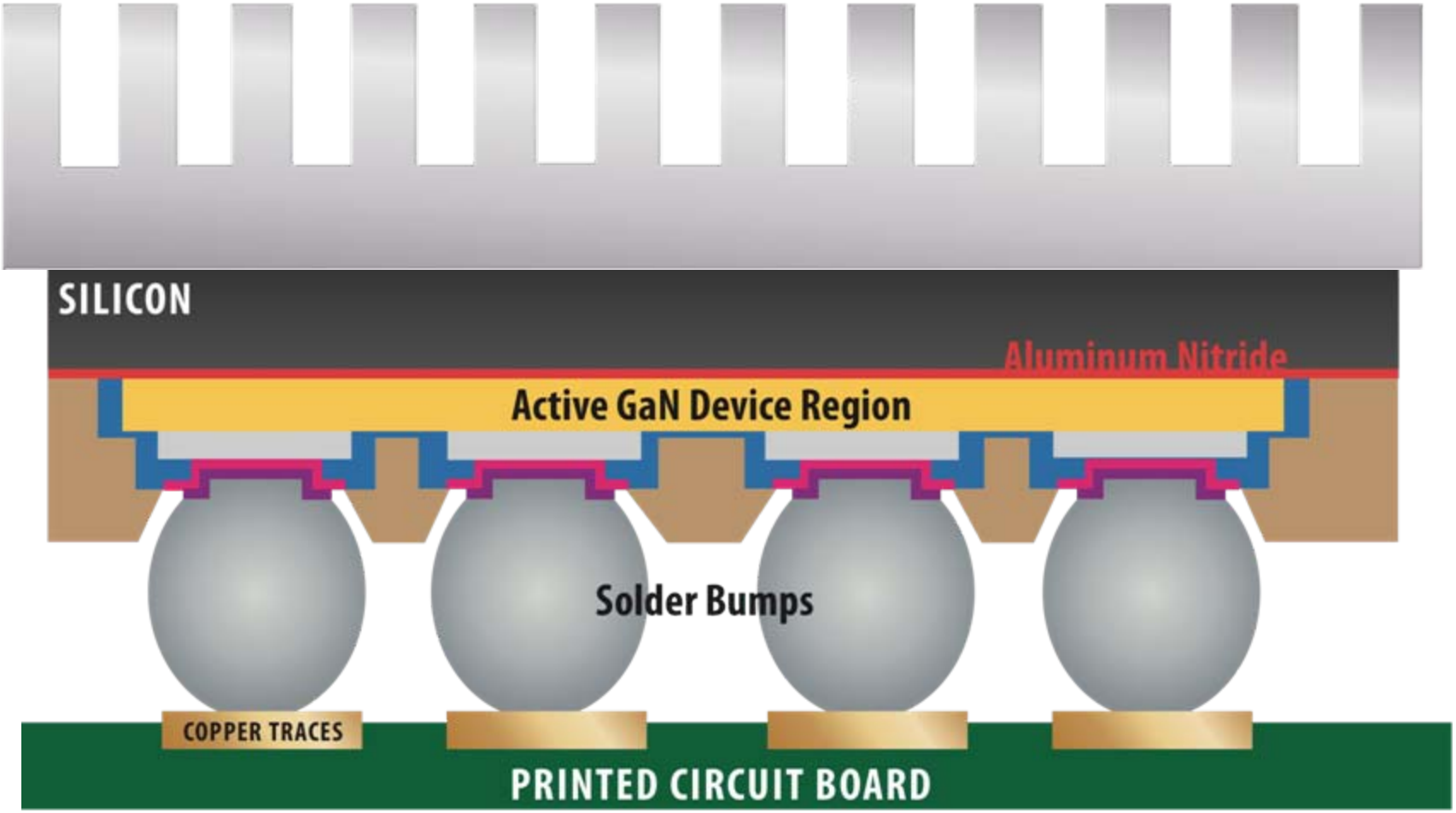




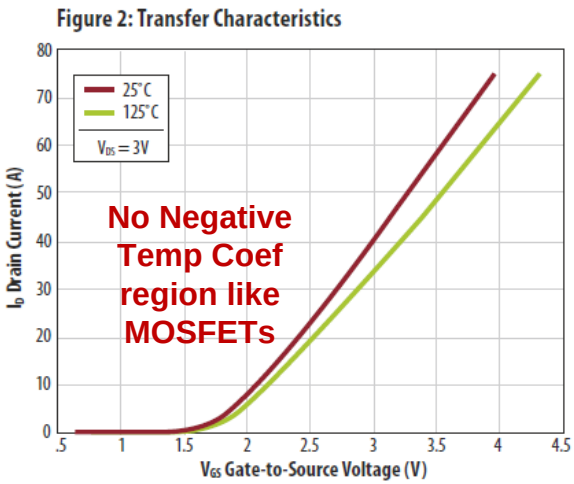
eGaN Structure

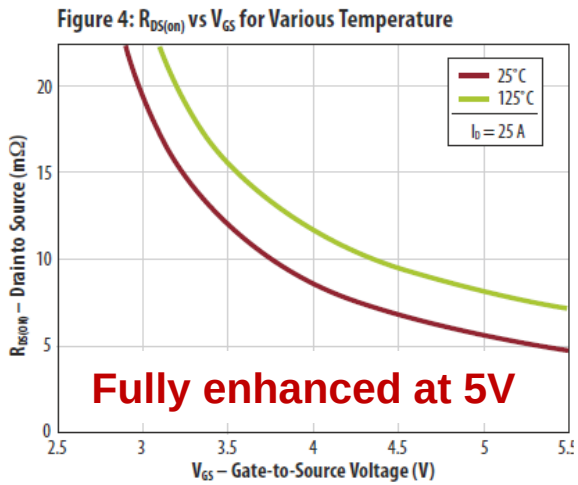


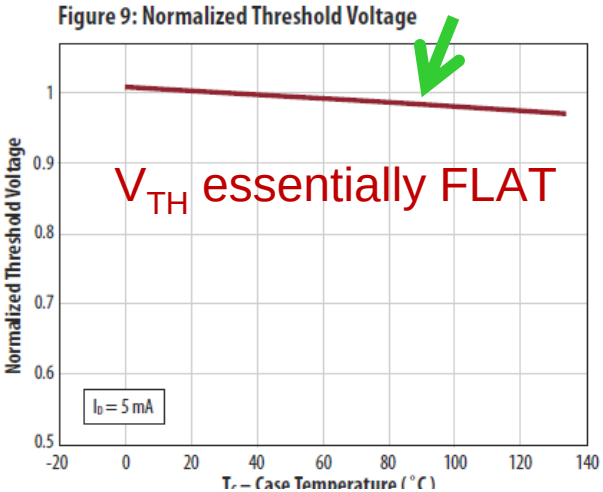
Flip Chip Assembly

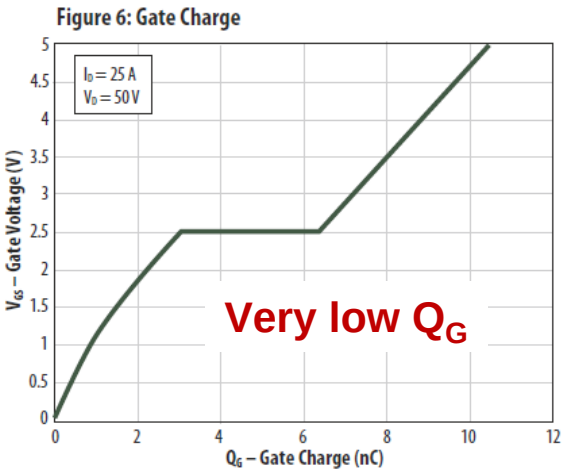


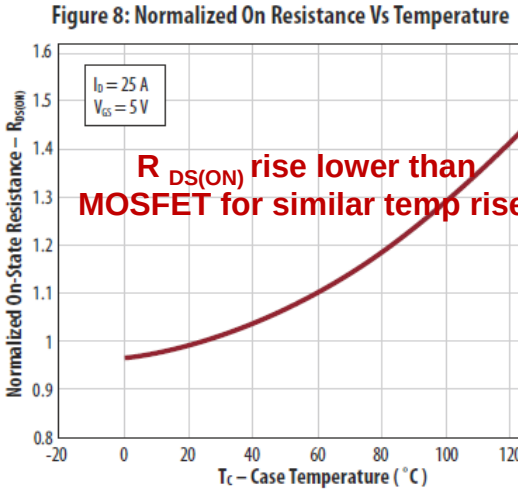
eGaN Characteristics

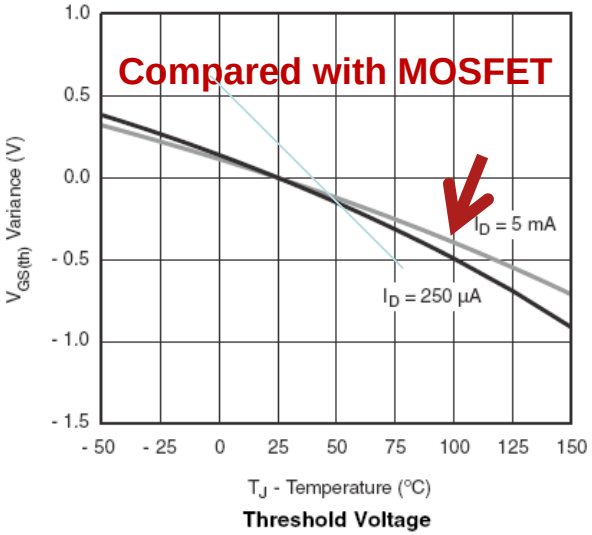












Is eGaN easy to use?

It's just like a MOSFET

except for TWO things

(1)

The high frequency capability makes circuits using eGaN transistors very sensitive to layout

(2)

eGaN transistors are more sensitive to gate rupture than power MOSFETs

EPC Shortform

Part Number	Package (mm)	Mode Ch	Vds	Vgs	Max. Rdson (mΩ) @5V	Qg @5V	Qgs Typ.	Qgd Typ.	Vth Typ.	Qrr	Id
Single											
EPC1014	LGA 1.7x1.1	EN	40	6	16.0	3.0	1.0	0.6	1.4	0	10
EPC1015	LGA 4.1x1.6	EN	40	6	4.0	11.6	3.8	2.2	1.4	0	33
EPC1009	LGA 1.7x1.1	EN	60	6	30.0	2.4	0.8	0.6	1.4	0	6
EPC1005	LGA 4.1x1.6	EN	60	6	7.0	10.0	3.0	2.5	1.4	0	25
EPC1007	LGA 1.7x1.1	EN	100	6	30.0	2.7	0.8	1.0	1.4	0	6
EPC1001	LGA 4.1x1.6	EN	100	6	7.0	10.5	3.0	3.3	1.4	0	25
EPC1013	LGA 1.7x0.9	EN	150	6	100.0	1.7	0.4	0.7	1.4	0	3
EPC1011	LGA 3.6x1.6	EN	150	6	25.0	6.7	1.5	2.8	1.4	0	12
EPC1012	LGA 1.7x0.9	EN	200	6	100.0	1.9	0.4	0.9	1.4	0	3
EPC1010	LGA 3.6x1.6	EN	200	6	25.0	7.5	1.5	3.5	1.4	0	12

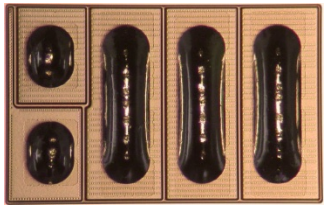
Preliminary information subject to change

Lead Free Available December 2010

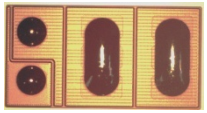
EPC *MOSFET Killer* Products

LGA 4.1x1.6 x0.8

LGA 3.6x1.6 x0.8

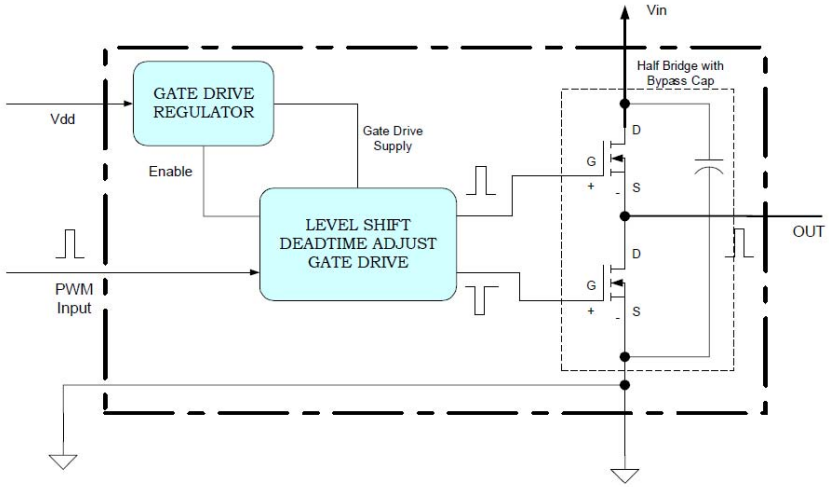


LGA 1.7x1.1x0.8



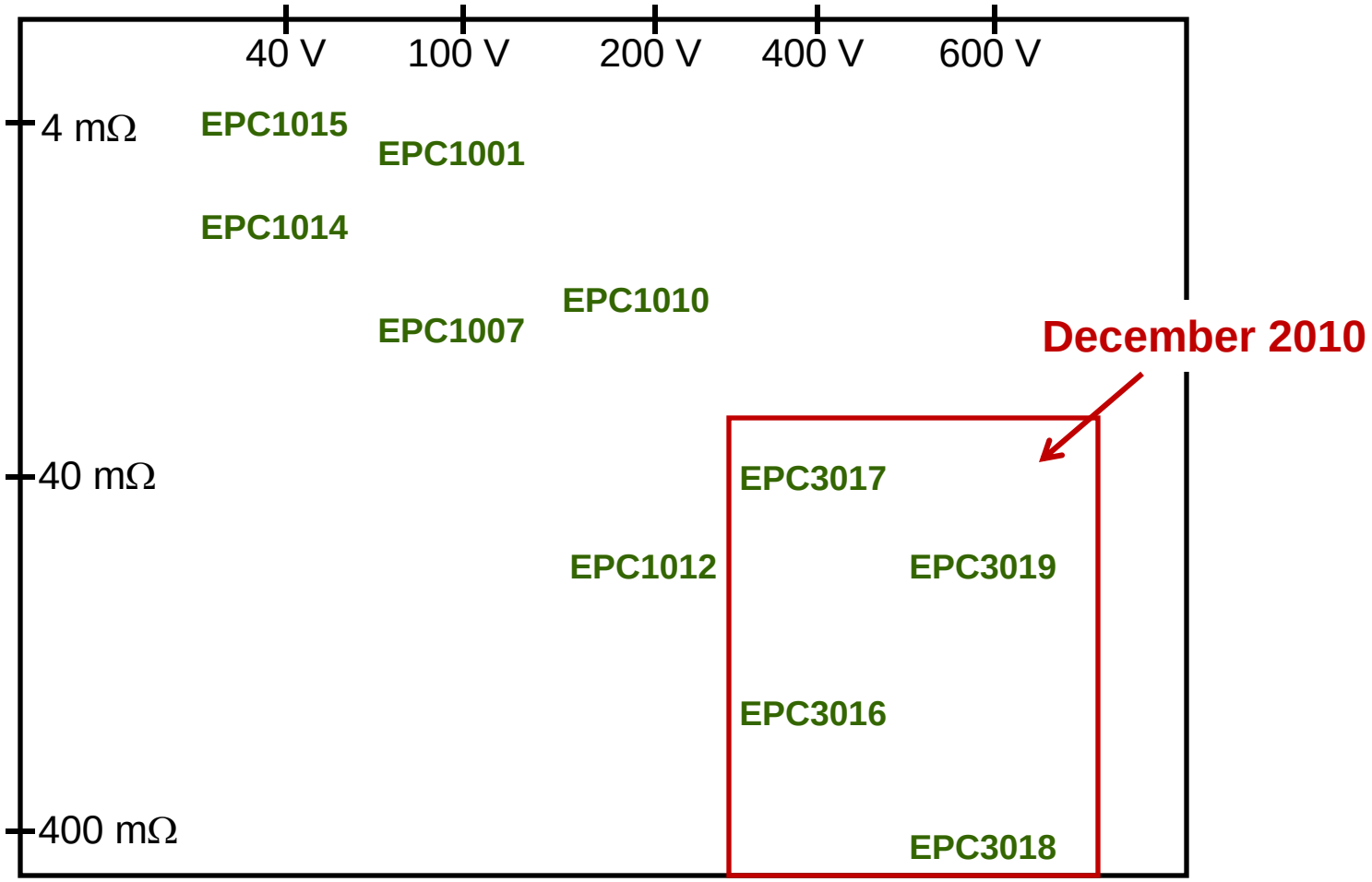
LGA 1.7x0.9x0.8

Development Board available

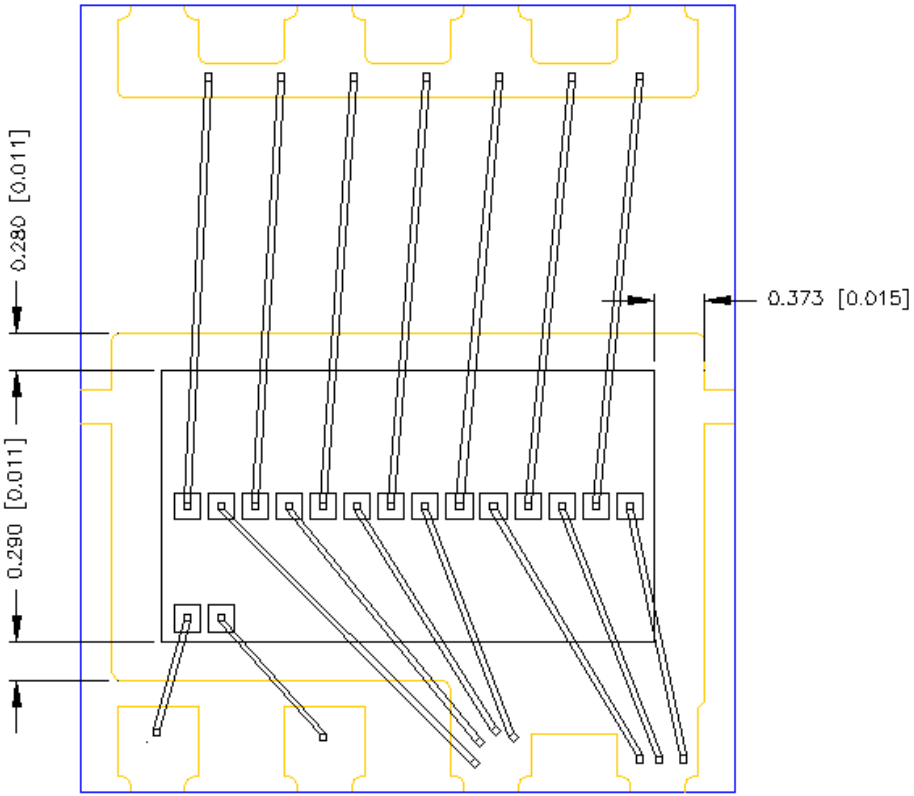


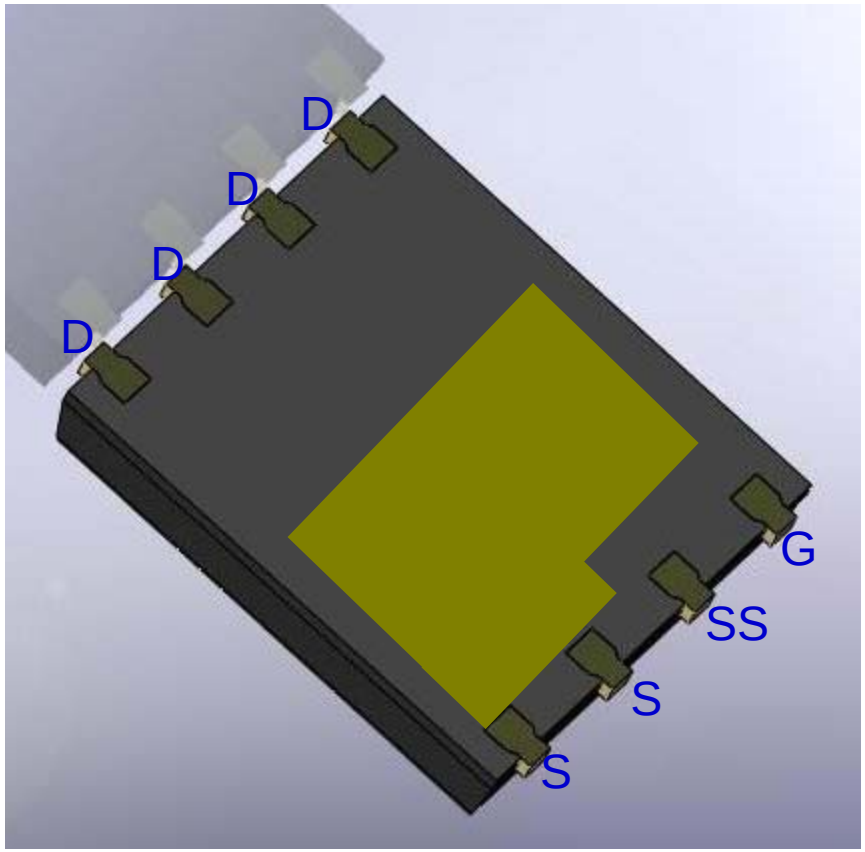
EPC *MOSFET Killer* Products

EPC's products will cover 90% of the existing power MOSFET market by the end of 2010



5x6 mm PQFN Package (GaNPAK)





EPC's 600V eGaN Products will be packaged in this industry standard package

Silicon Vs eGaN Costs

	2010	2015
Starting Material	same	same
Epi Growth	higher	same
Wafer Fab	same	lower
Test	same	same
Assembly	lower	lower
OVERALL	**higher**	**lower**

…Silicon has reached the end of the road.