

The eGaN<sup>®</sup> FET  
Journey Continues

# GaN-on-Si in Power Conversion

*Alex Lidow, CEO*

October 2016

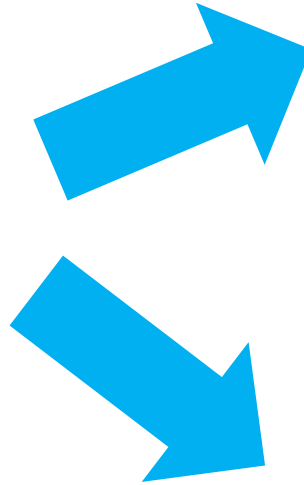
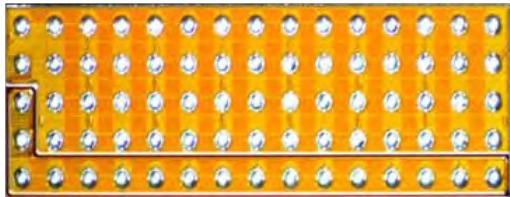
# Agenda



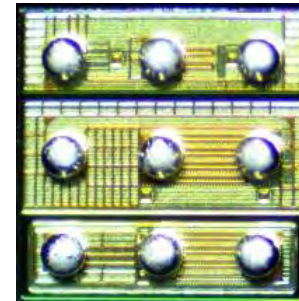
- How far have we come?
- What paths are we taking?
- Where is the leverage for integration?
- The road ahead.

# Fast Moving Technology

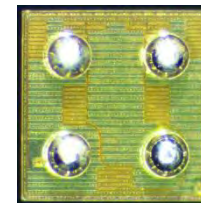
**Gen 1,2,3,4 FETs and ICs**  
**2010-2015**  
**30 V - 450 V**



**Higher Scale**  
**Integrated Circuits**



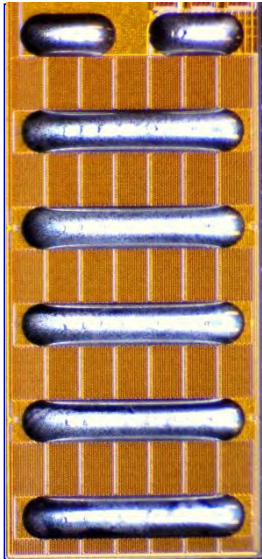
**Generation 5**  
**Smaller, Faster, Less Cost**



# Gen 5: 1/2 size and 2X performance

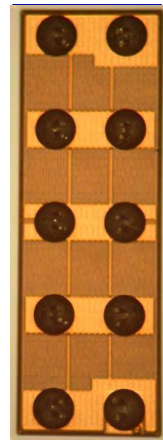
**EPC2010C**  
25 mOhm

6.06 mm<sup>2</sup>



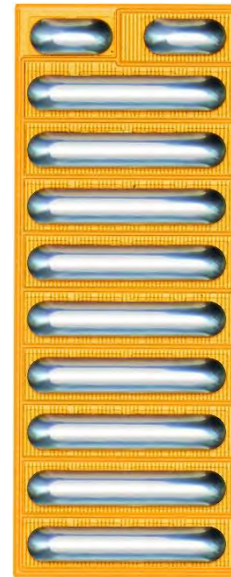
**EPC2046**  
25 mOhm

2.82 mm<sup>2</sup>



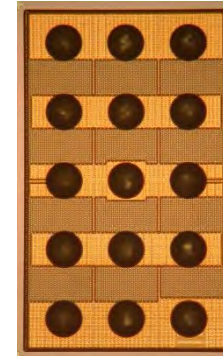
**EPC2001C**  
7 mOhm

6.99 mm<sup>2</sup>



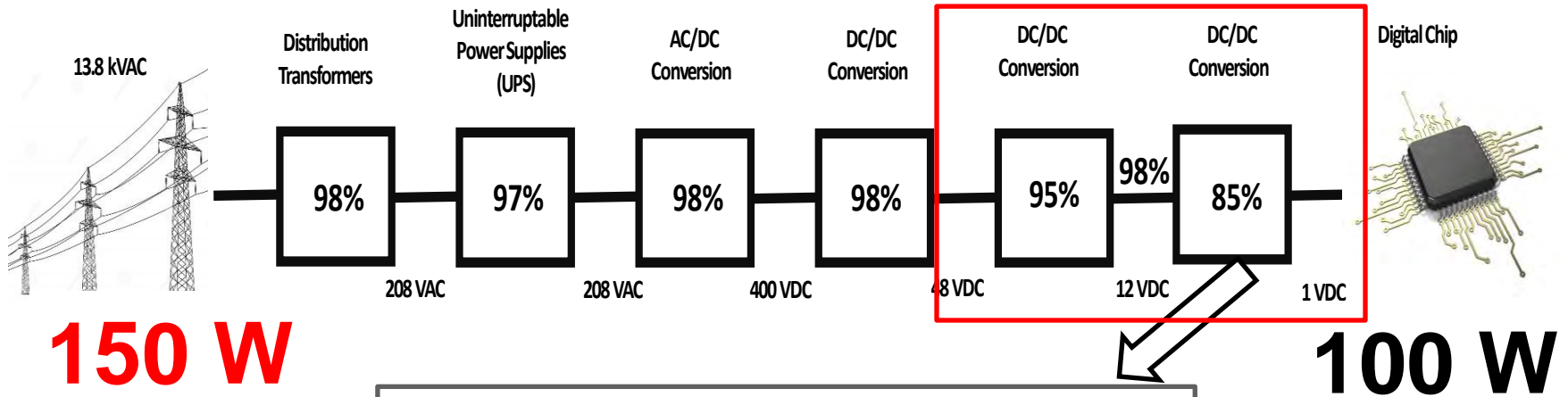
**EPC2045**  
7 mOhm

3.96 mm<sup>2</sup>

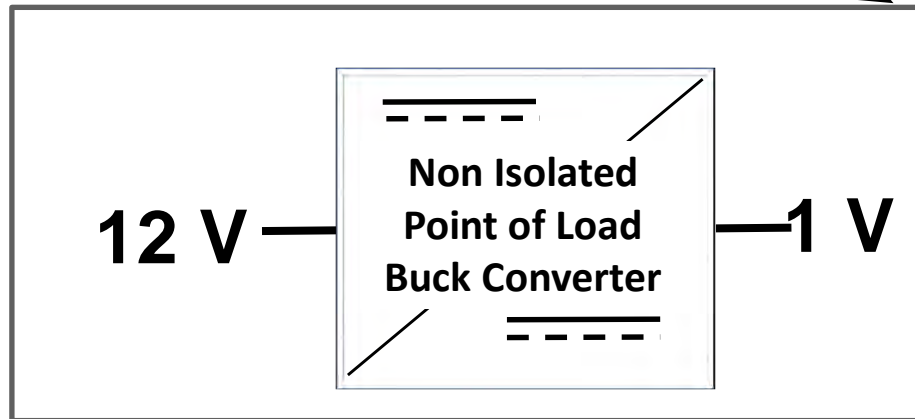




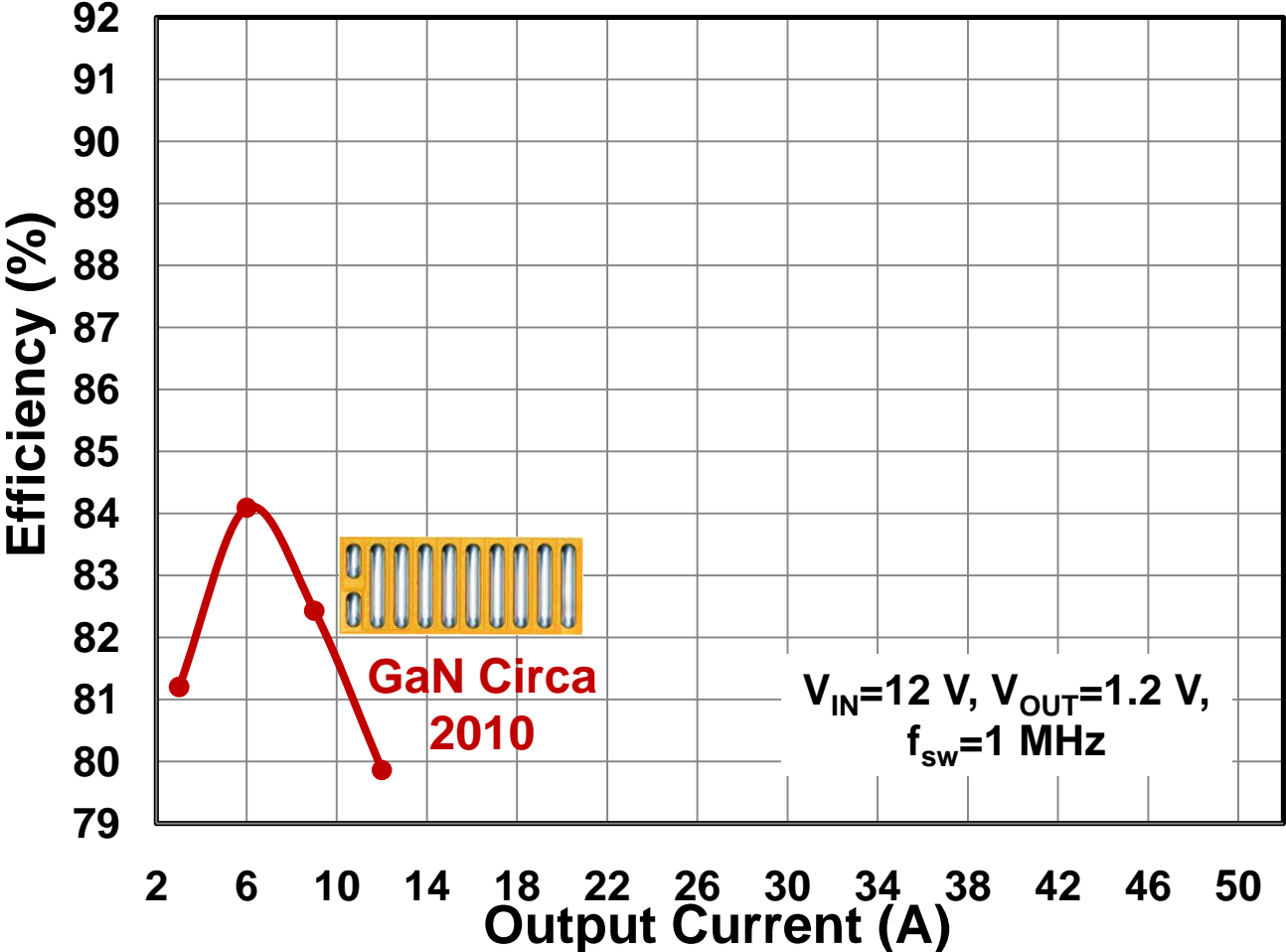
# 79% Efficient



**150 W**

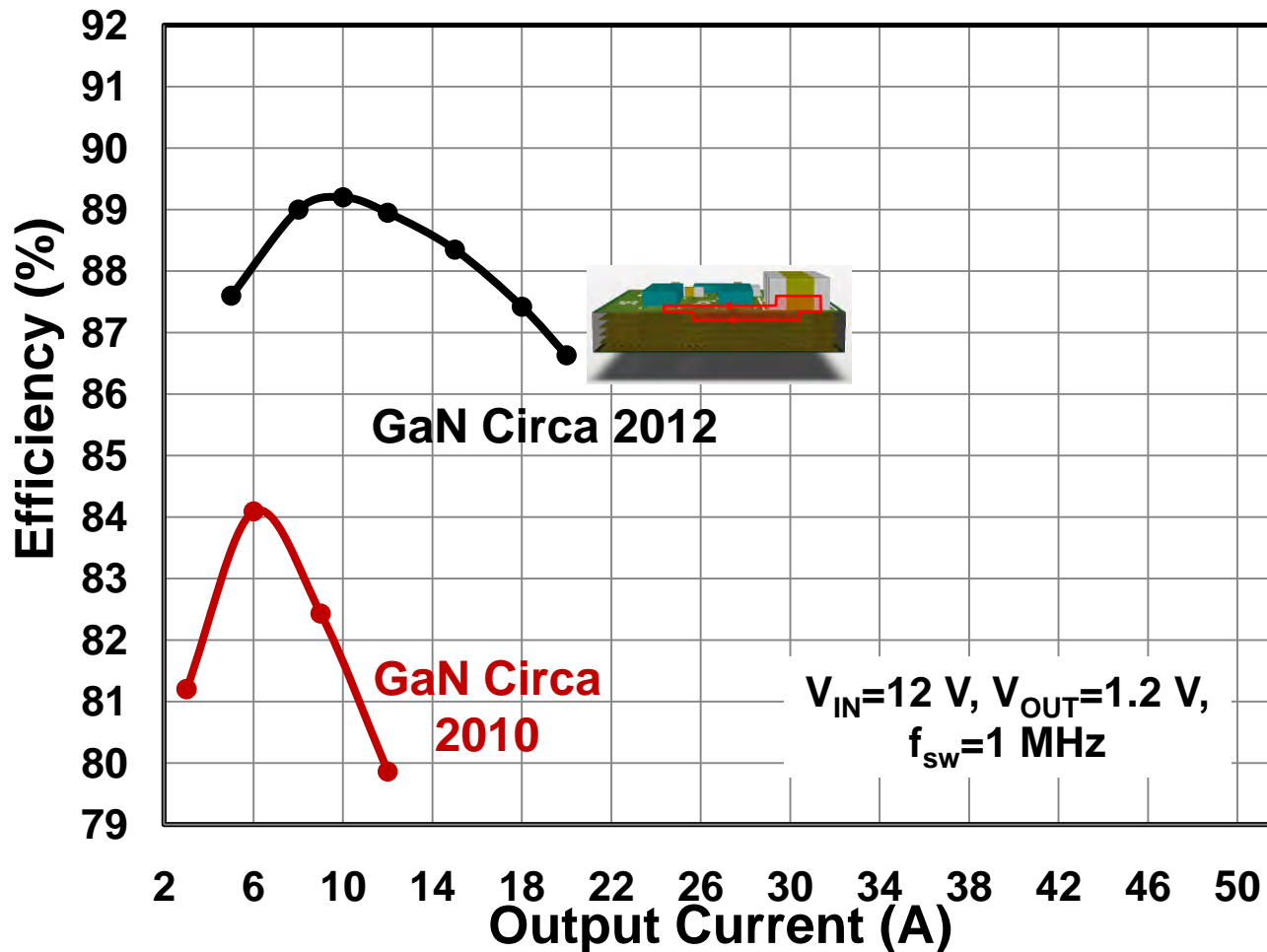


# First Generation eGaN® FET

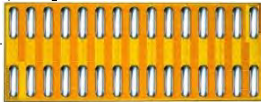
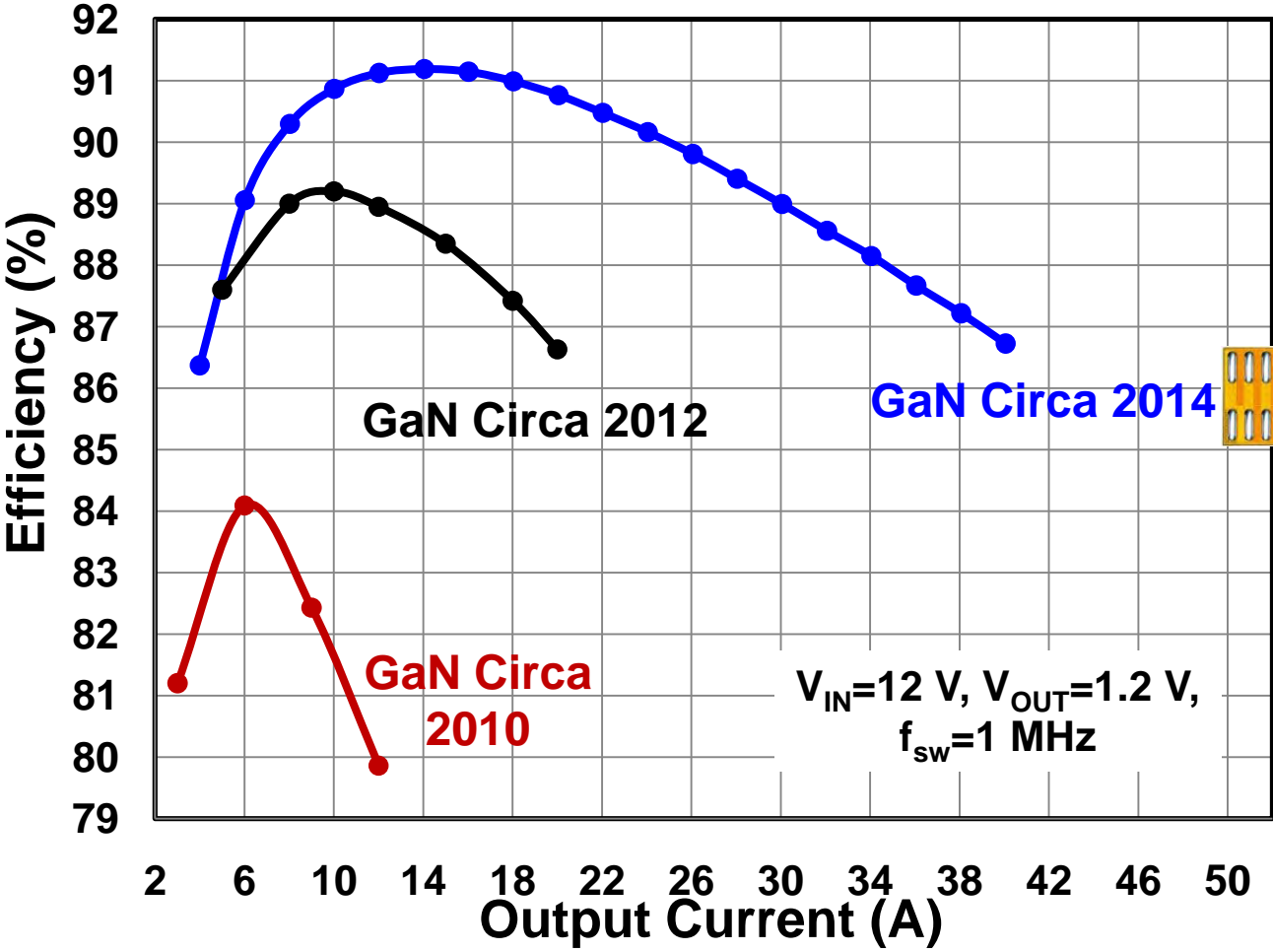


eGaN® is a registered trademark of Efficient Power Conversion Corporation

# Improved Layout

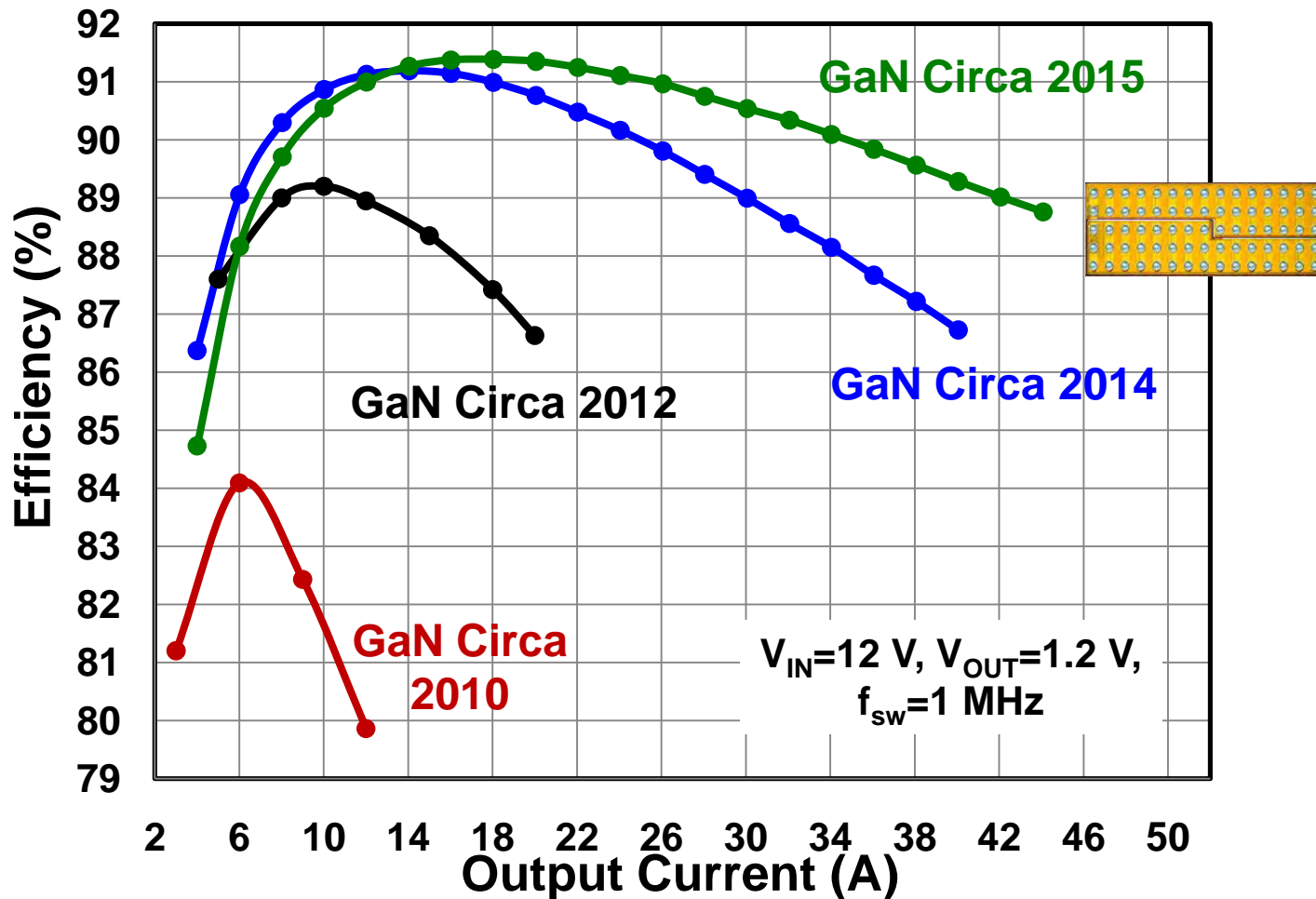


# Fourth Generation eGaN FET

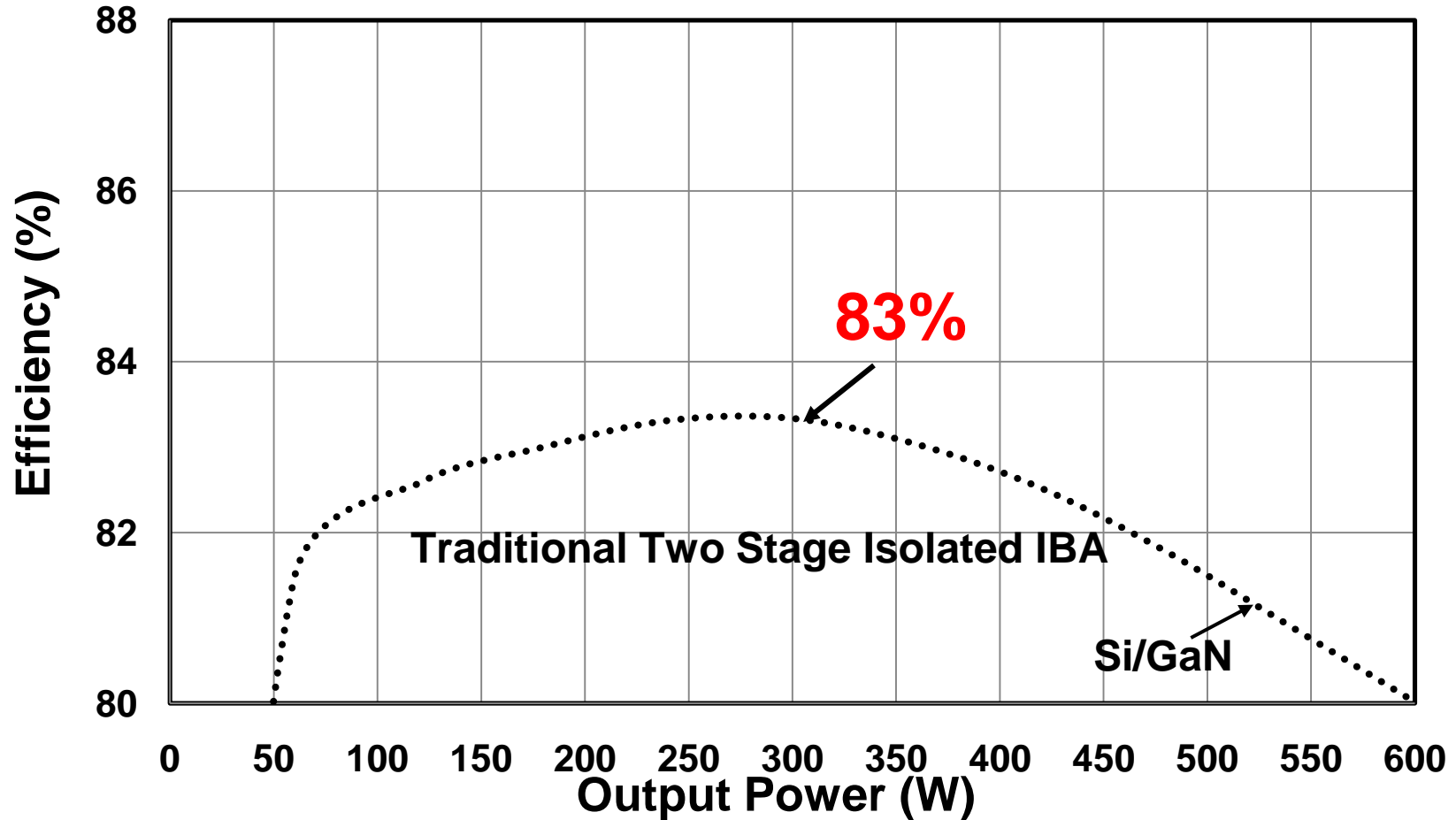




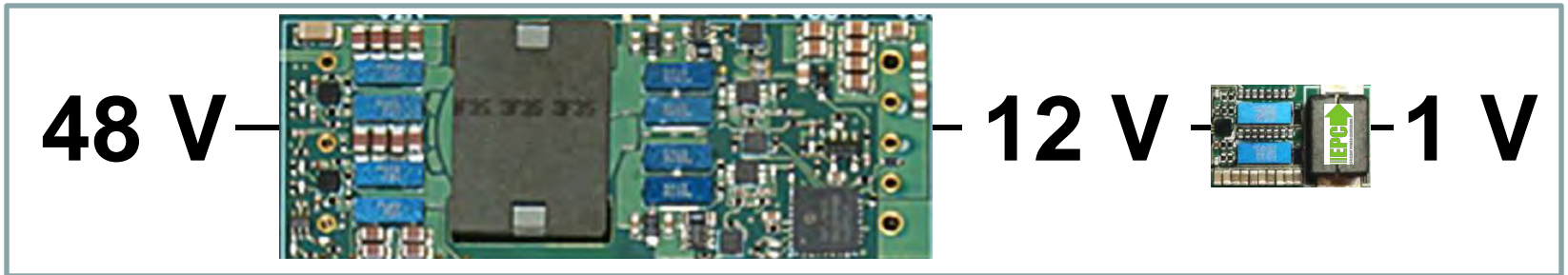
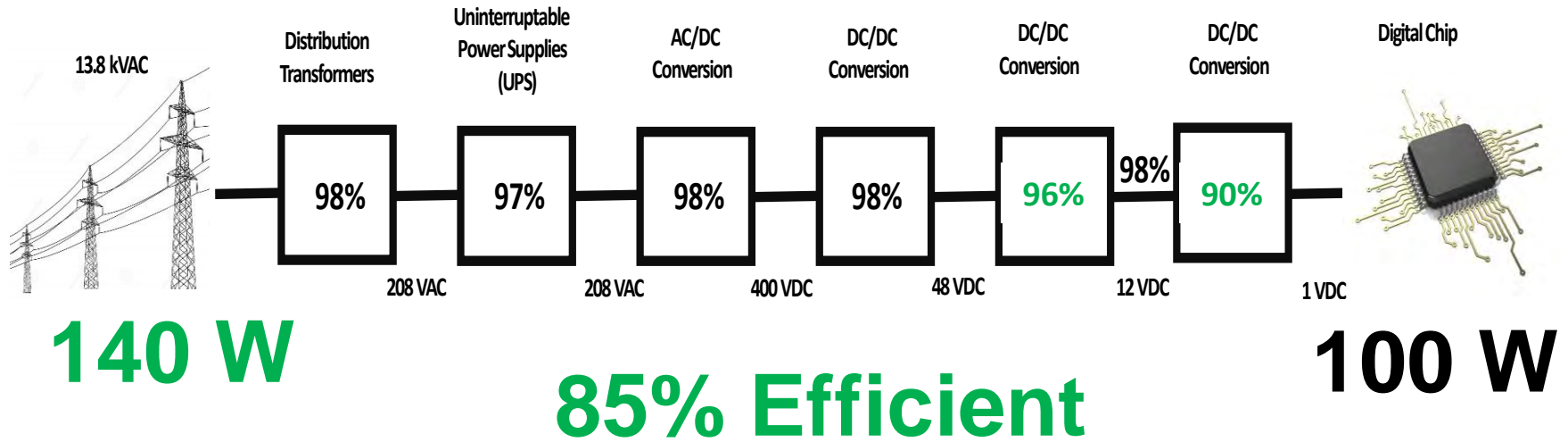
# Monolithic Half Bridge



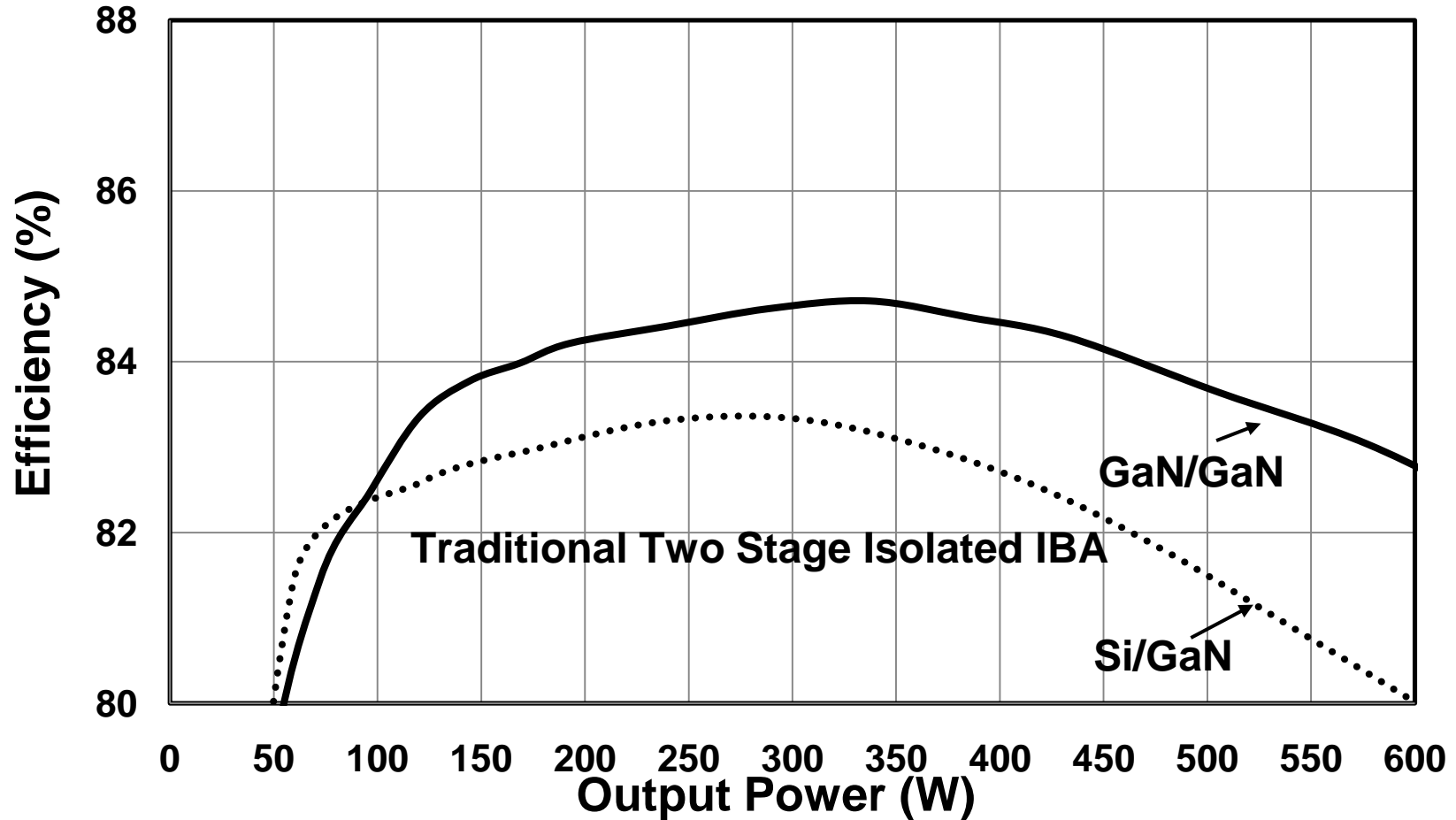
# Silicon IBC and GaN POL



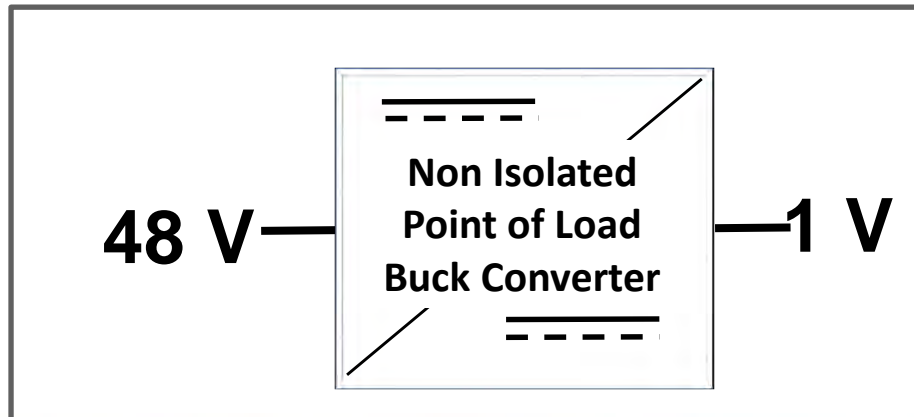
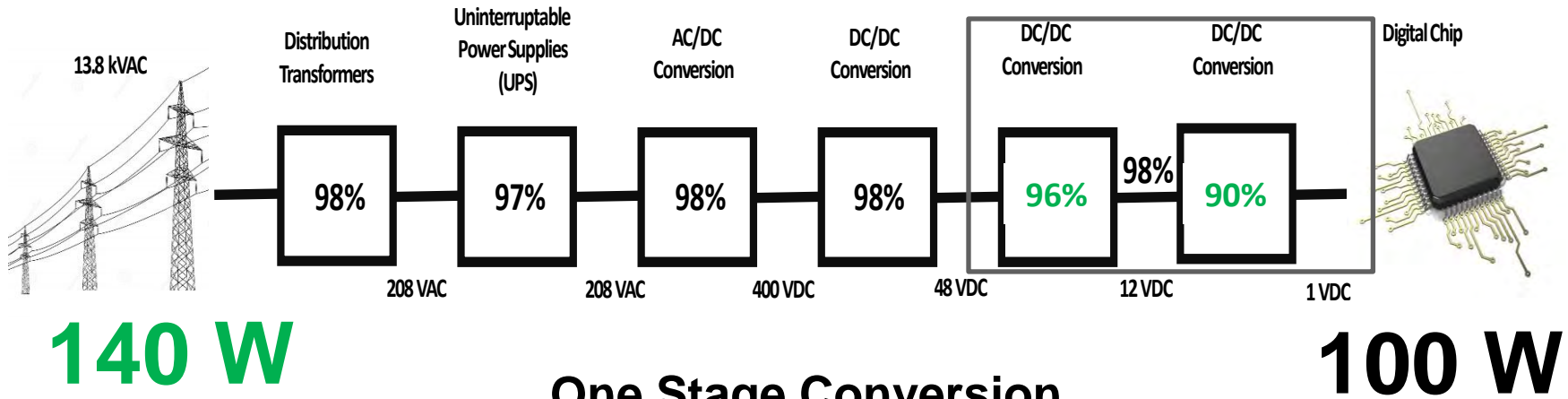
# eGaN FETs and ICs



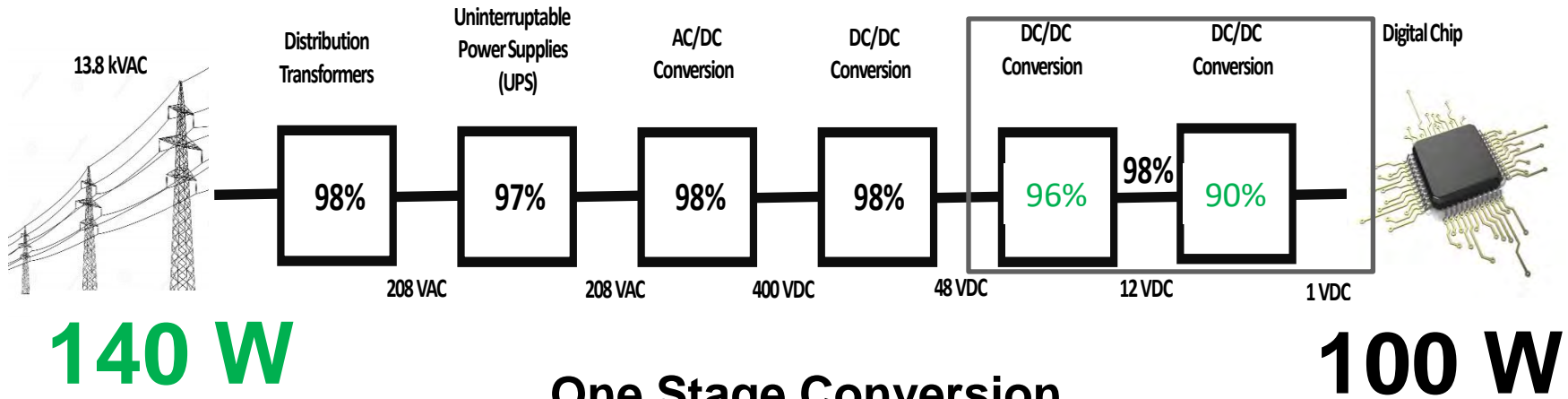
# eGaN FETs and ICs



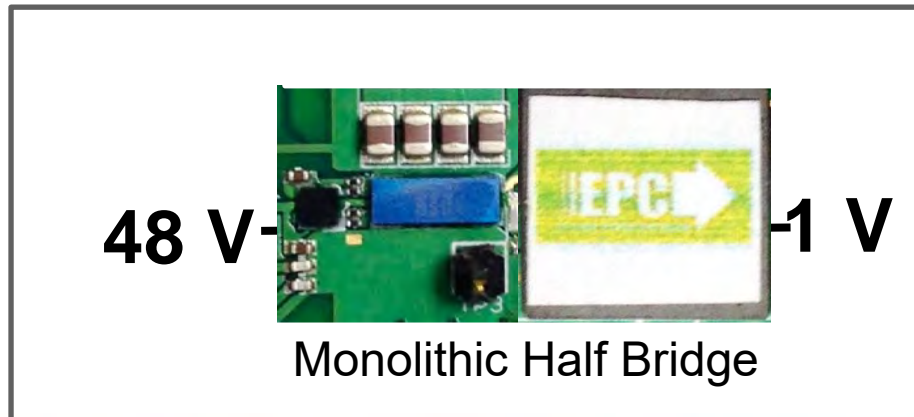
# Eliminate 12 V Bus



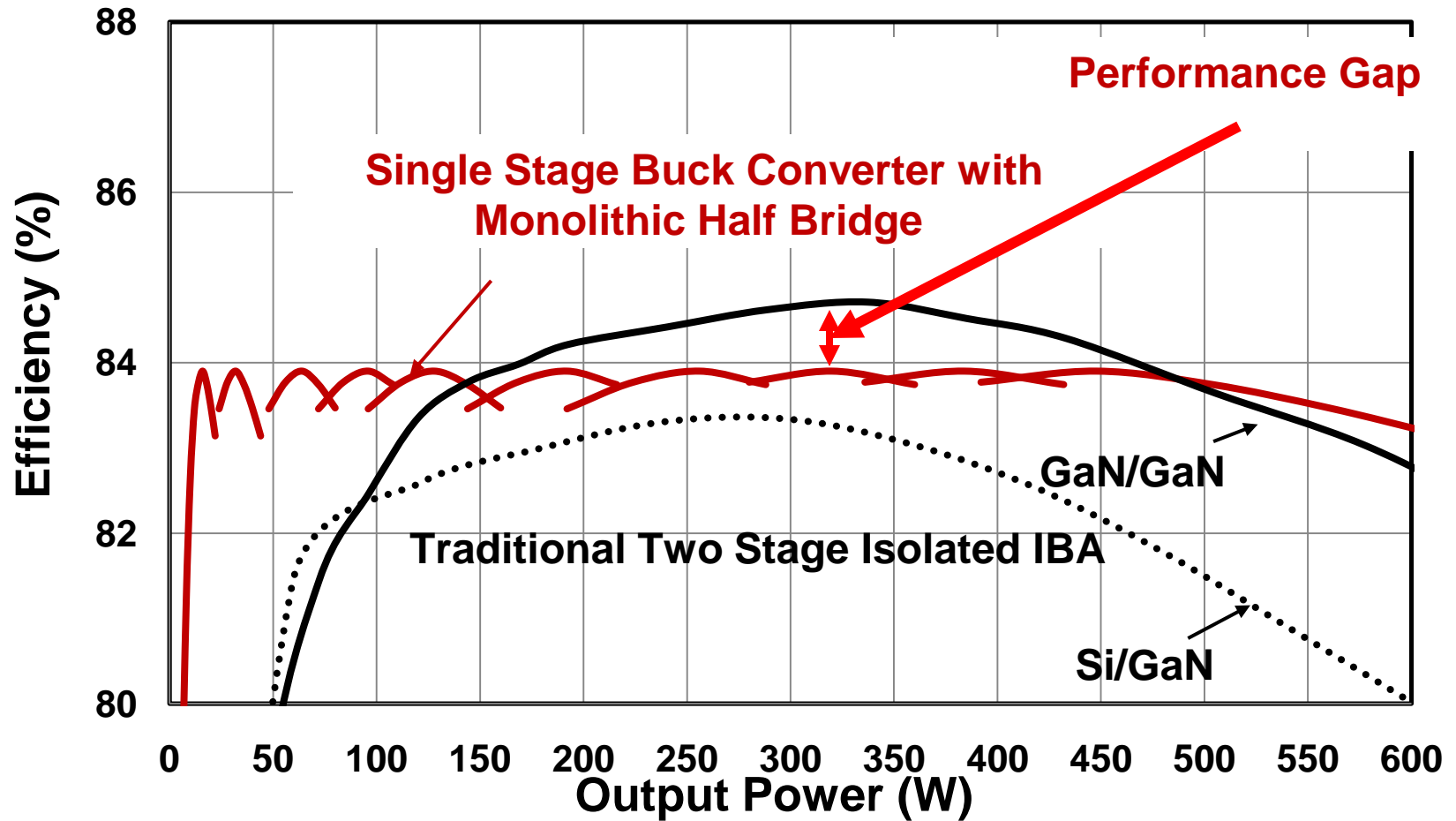
# Eliminate 12 V Bus

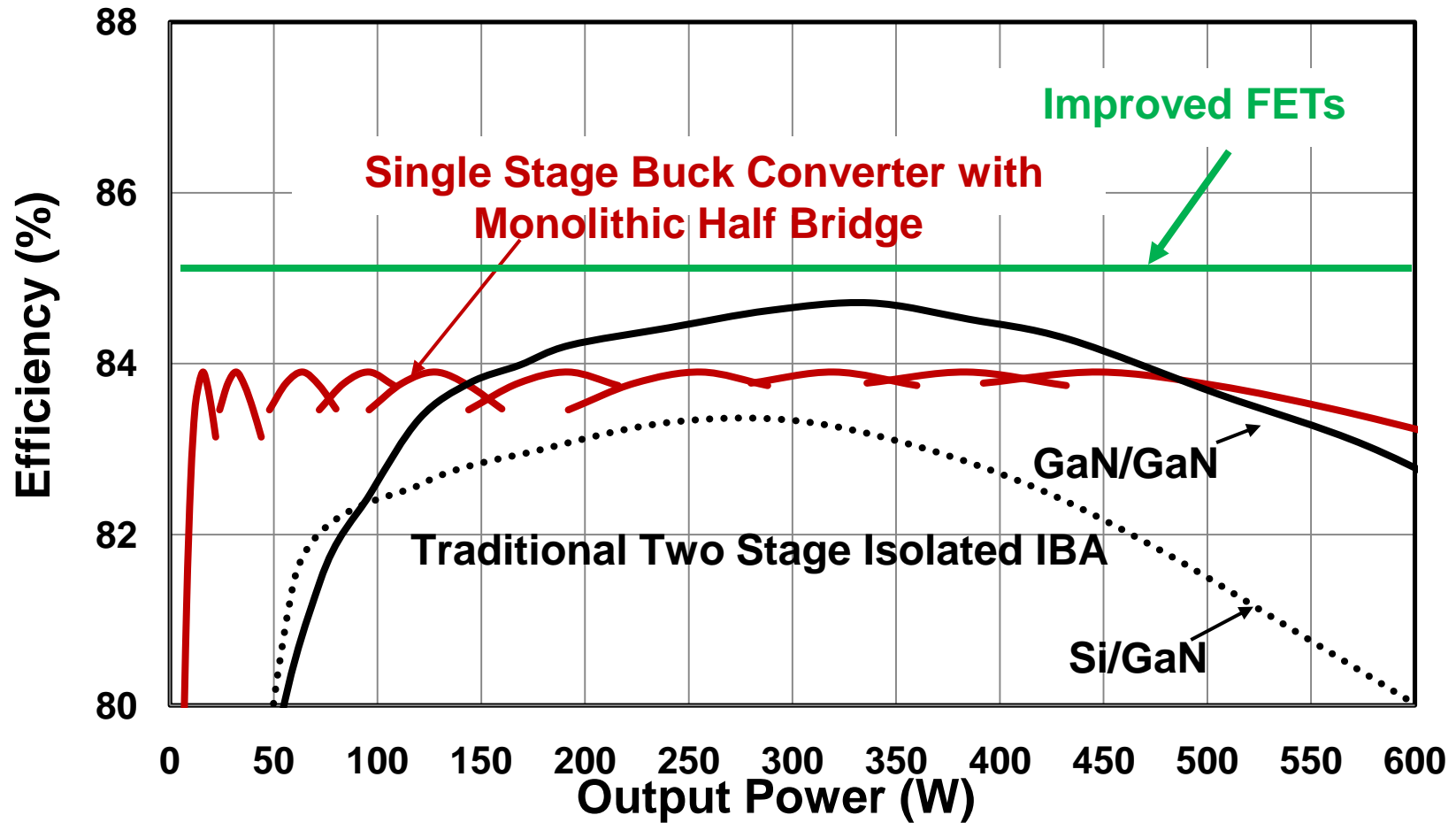


One Stage Conversion









# GaN Integrated Circuit Roadmap



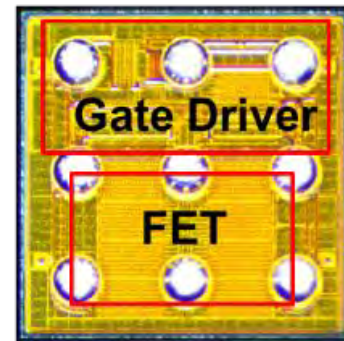
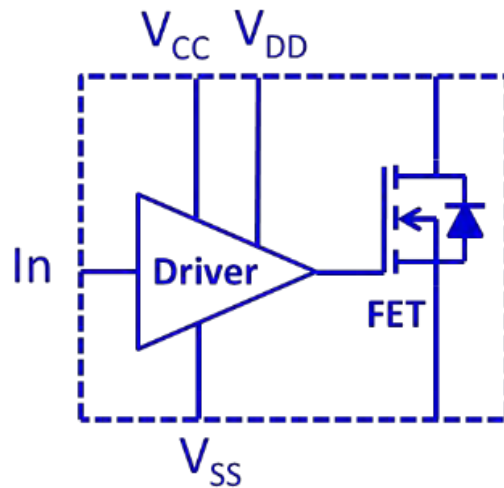
- ✓ Monolithic Half Bridge
- ✓ Half Bridge plus Bootstrap
  - Integrated FET and low side driver
  - Integrated half bridge with level shift and drivers
  - Monolithic Buck IC

# GaN Integrated Circuit Roadmap



- ✓ Monolithic Half Bridge
- ✓ Half Bridge plus Bootstrap
- **Integrated FET and low side driver**
- Integrated half bridge with level shift and drivers
- Monolithic Buck IC

# First Step - Integrated FET and Low Side Driver

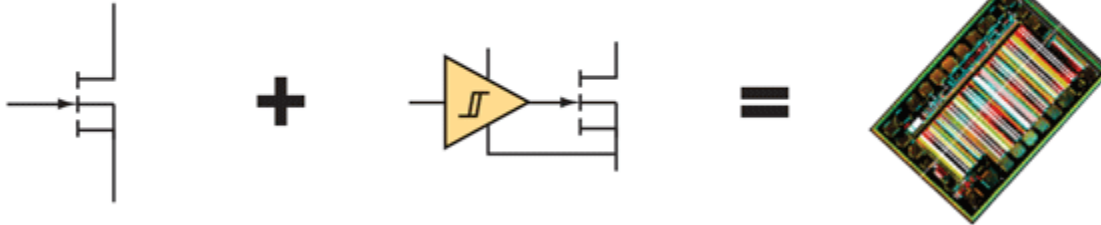


# Monolithic Gate Driver and FET

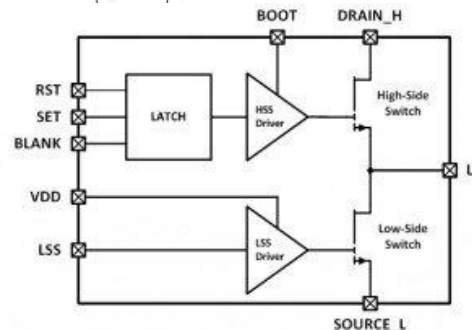
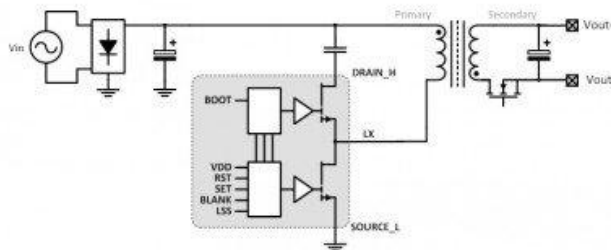
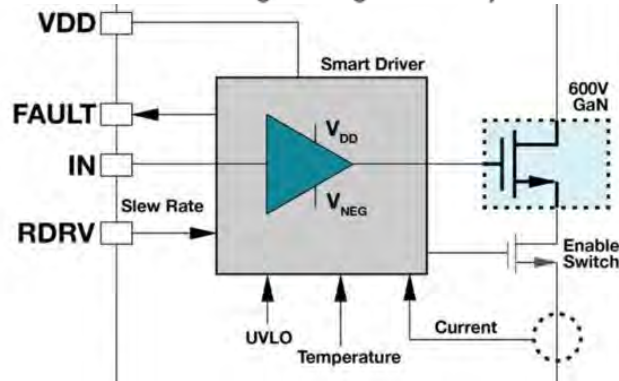
Fastest, more efficient  
GaN Power FETs

First & Fastest  
Integrated GaN Gate Driver

AllGaN  
Power IC



Up to 40 MHz switching, 4x higher density & 20% lower system cost

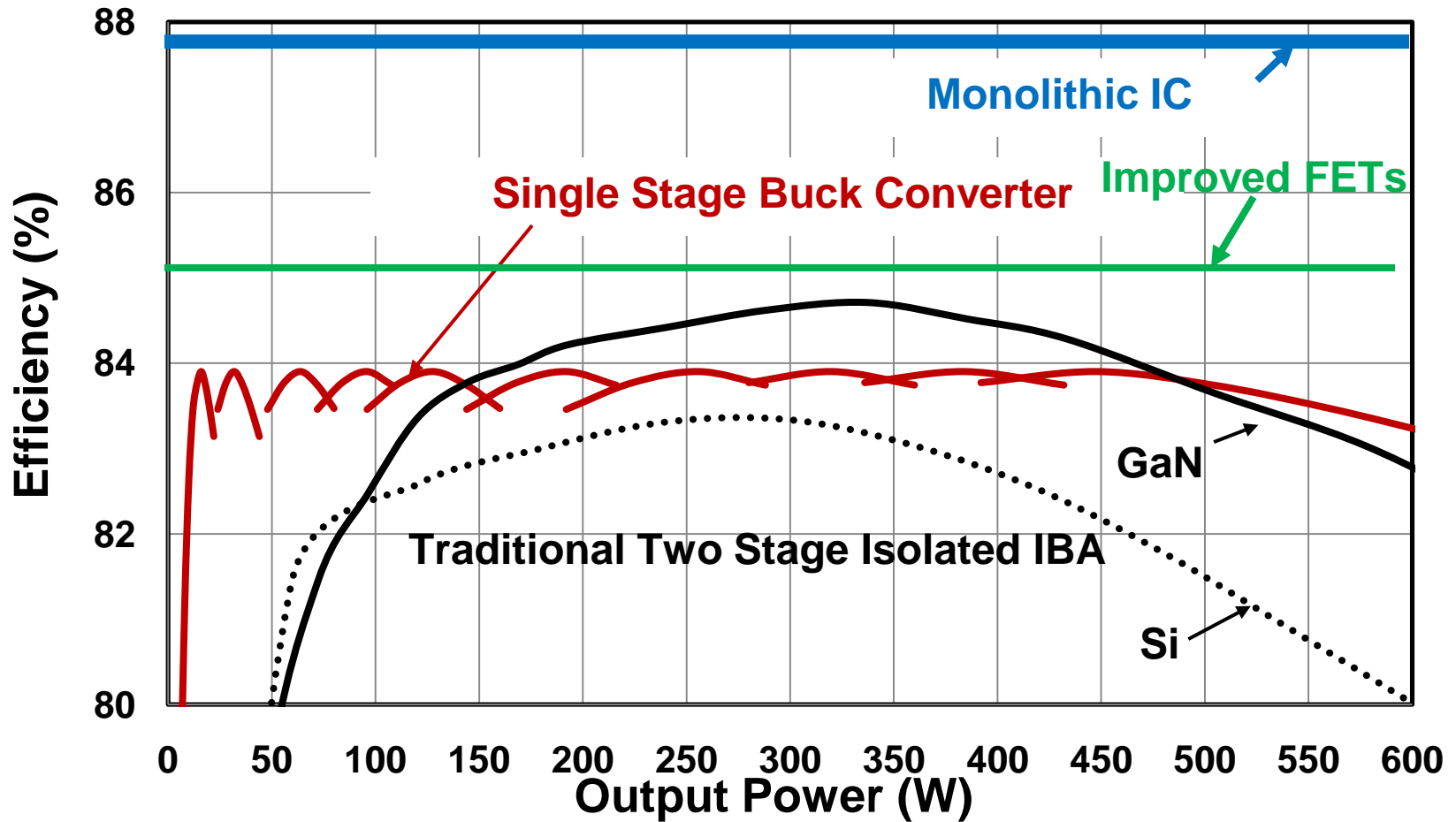


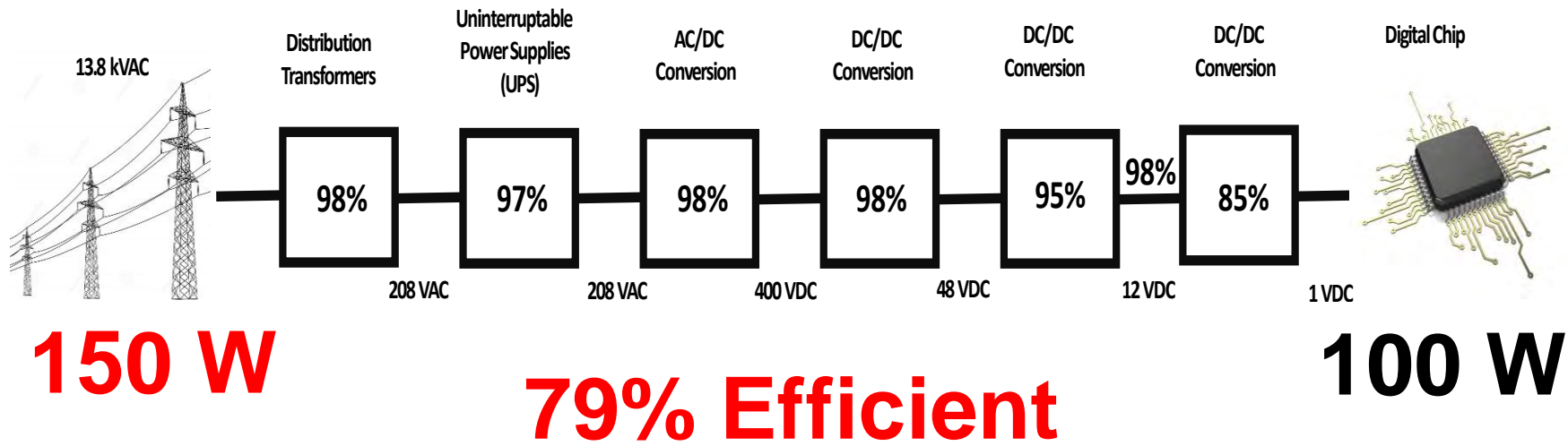


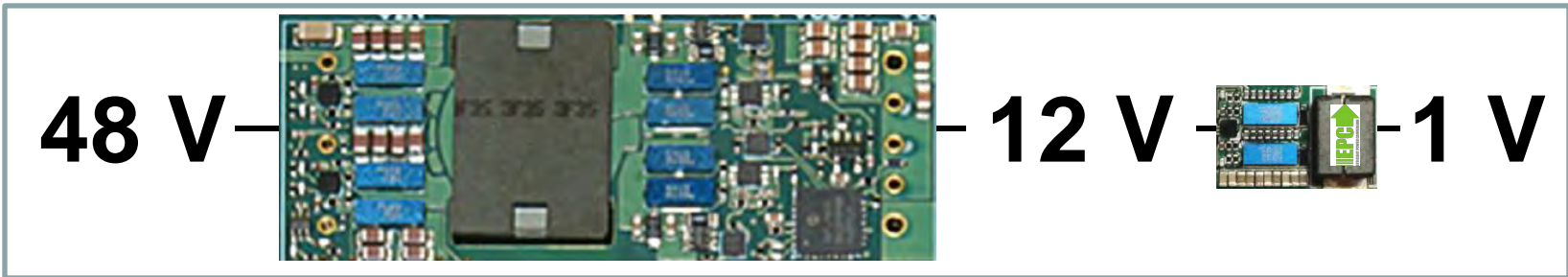
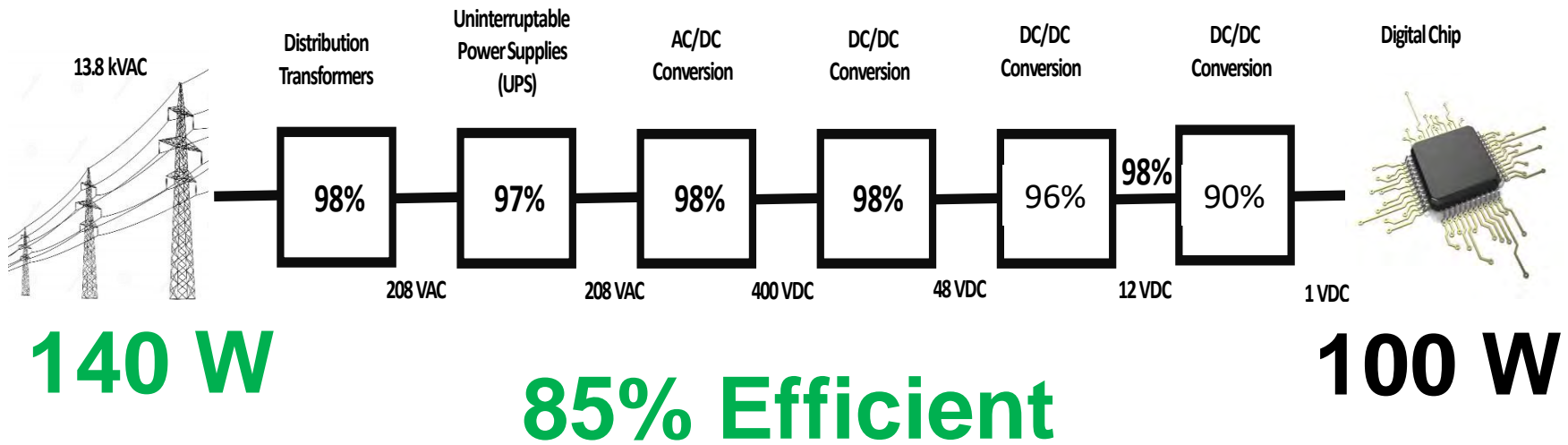
# GaN Integrated Circuit Roadmap



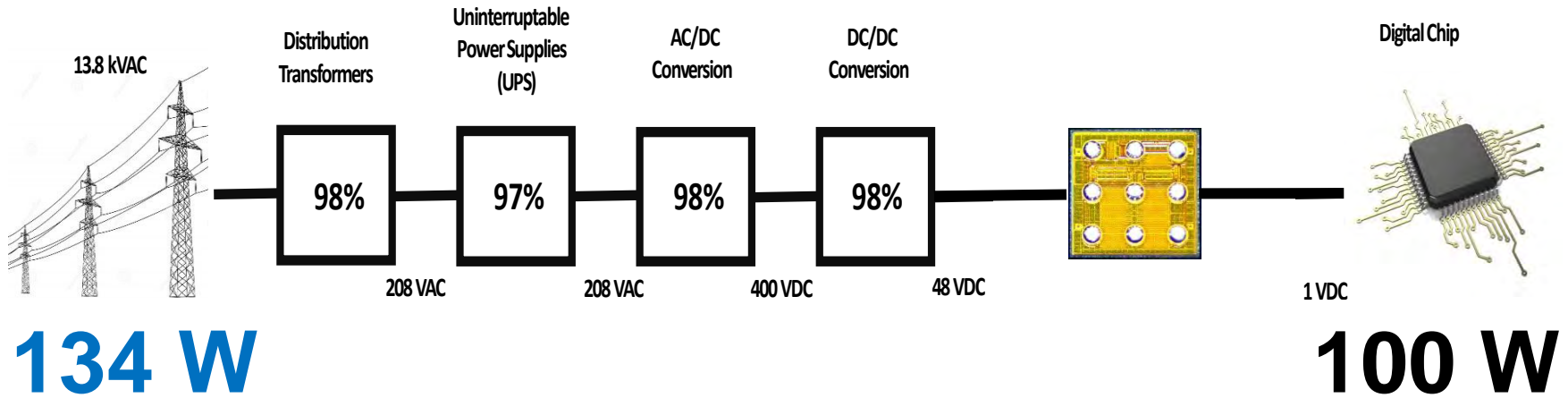
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- ✓ Half Bridge plus Bootstrap
- Integrated FET and low side driver
- Integrated half bridge with level shift and drivers
- Monolithic Buck IC





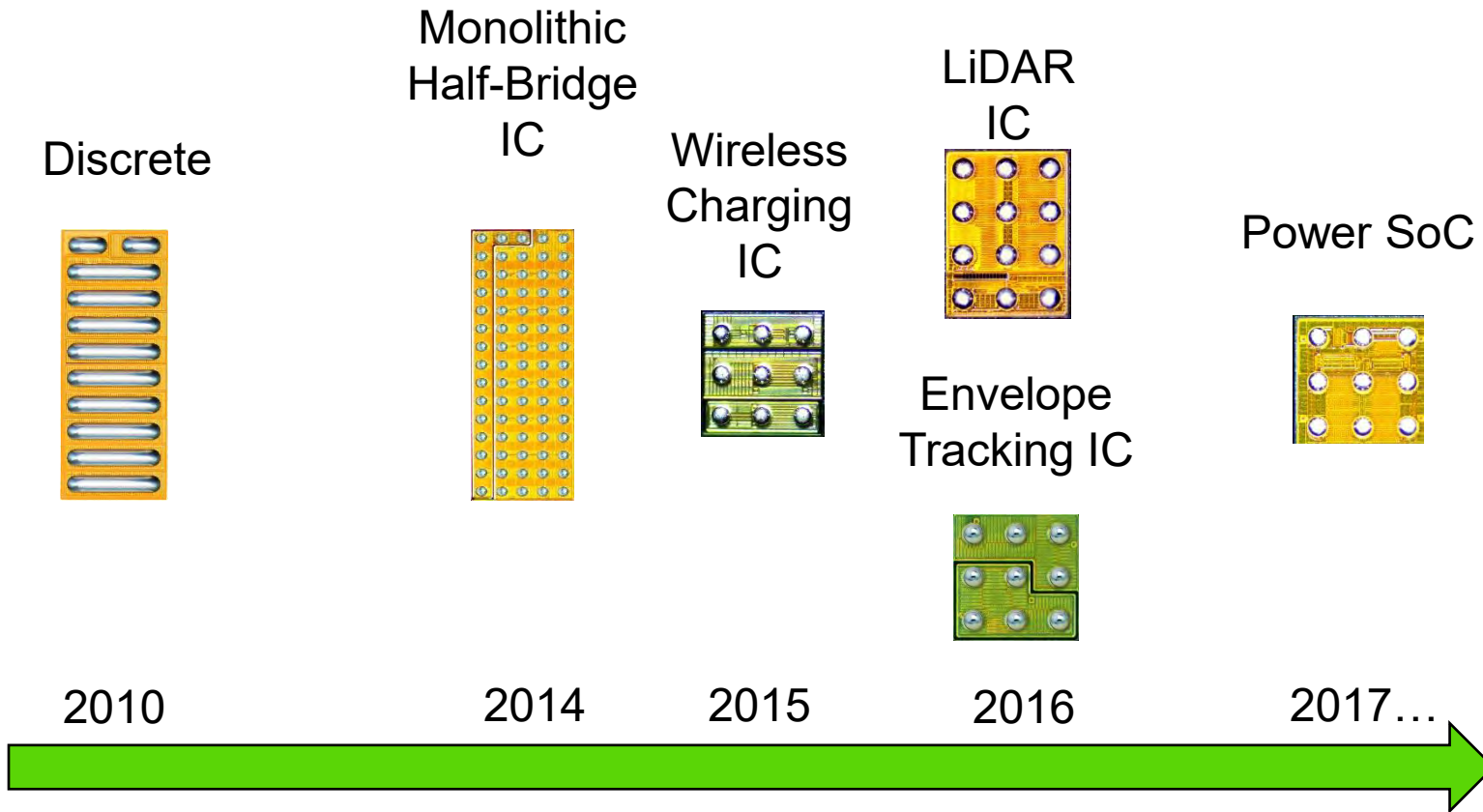


# eGaN Integrated Circuit



**88% Efficient**

# eGaN Integration Roadmap





# Summary

- GaN integration creates a lot of performance leverage.
- The first steps in integration involve reducing parasitic inductance and integration of drive circuitry.
- The second stage involves including level shift and current sense.
- The third stage will include control circuitry in both analog and digital.