IMS 2023 MicroApps

A 3 kW GaN-SiC Pallet Amplifier for S-Band Directed Energy Applications Operating at 100 V

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AGENDA

1. Why 100V?
2. Pallet Design
3. Measured Results
4. Comparison with 50V Solution
5. Conclusions

1. Why Use 100V GaN?

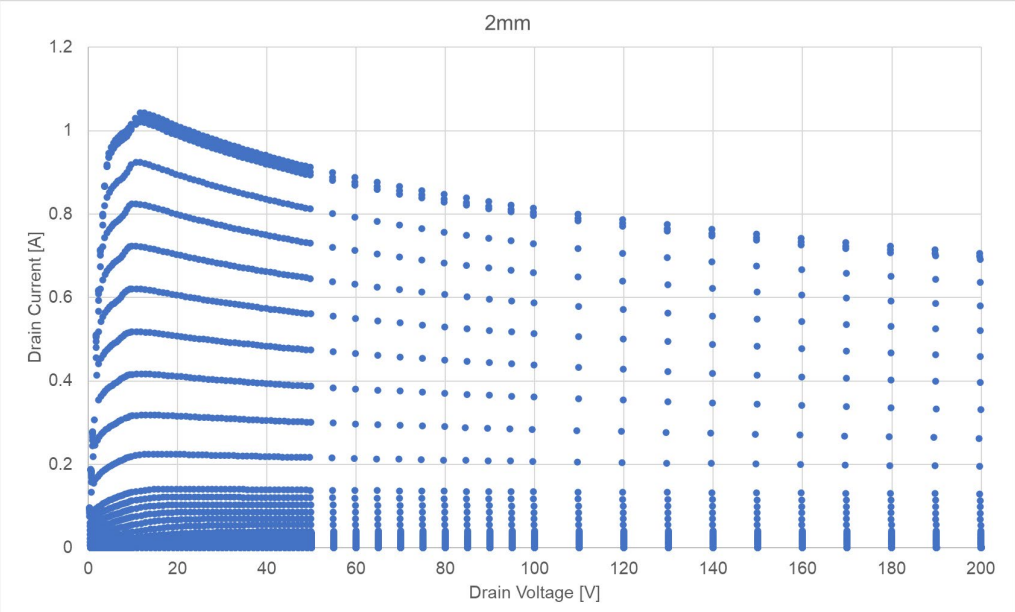
- High RF Power requires either:
  - Large RF Current swing
- Or
  - Large RF Voltage swing
- Or
  - Both

Large RF Current Swing vs Large RF Voltage Swing

Large RF Current Swing	Large RF Voltage Swing
Increased gate width	Unchanged gate width
Increased die size	Unchanged die size
Increased die cost	Unchanged die cost
Reduced Real part of Z_L	Increased Real part of Z_L
Increased C_{DS}	Little change in C_{DS}
Unchanged dissipated power density	Increased dissipated power density

Increased dissipated power density not necessarily a problem for pulsed operation

100V GaN Die Properties



- Knee Voltage 1/10th Drain voltage - the same as for 50V GaN
  - Theoretical maximum efficiency is same for both 50V and 100V GaN die
- MTF > 10^6 hrs at 225^{0}C (> 10^7 hrs at 200^{0}C) – the same as for 50V GaN
- 100V GaN uses same packages as 50V GaN
- Fully qualified process
- In Production

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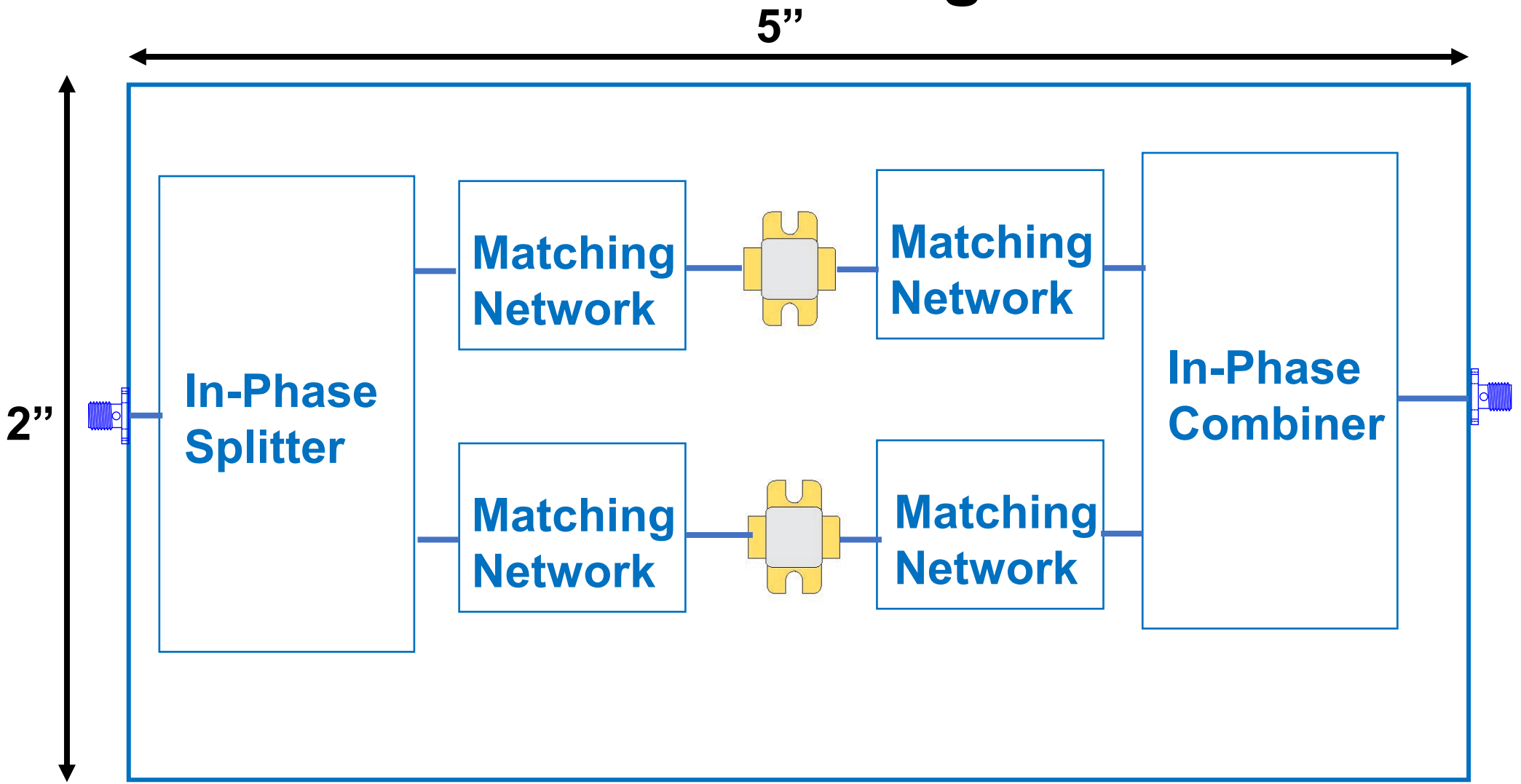
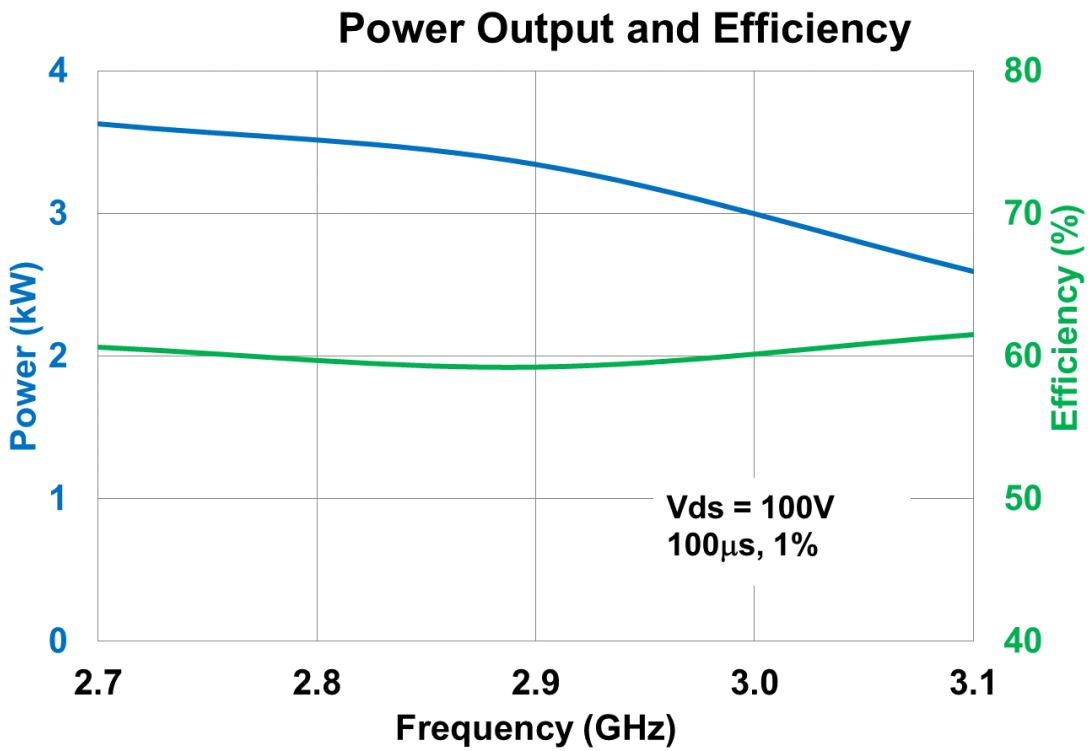
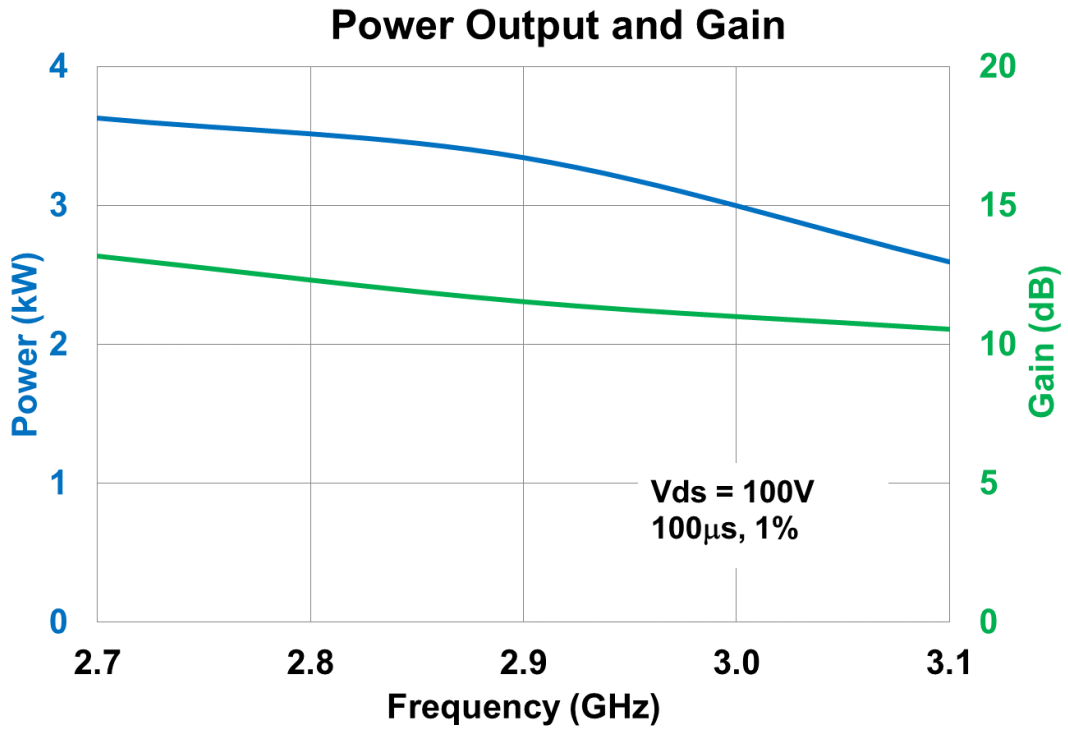
2. Pallet Design



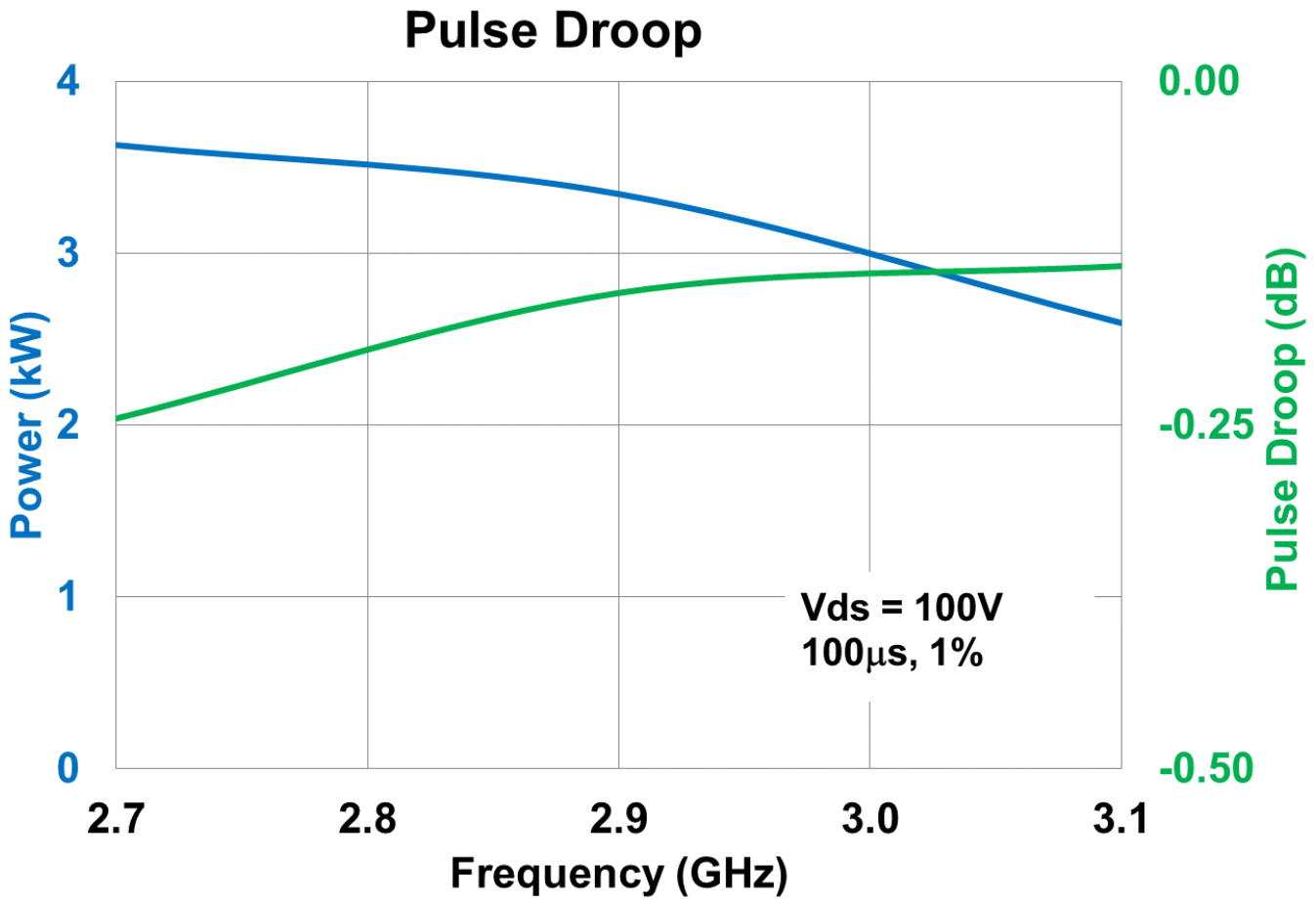
3. Measured Results





Power output measured at approximately 2dB gain compression

3. Measured Results



4. Comparison with 50V Solution

Power output from a single transistor over 2.7 – 3.1 GHz

50V	725 – 630W
100V (this work)	1911 – 1695W

- **100V more than doubles RF output power**

- **This paper reports the highest power yet achieved from a transistor at S band**

4. Comparison with 50V Solution

- 100V halves the number of transistors needed for 3kW pallet
  - Halves pallet size
  - Only needs 2-way instead of 4-way combiner
    - Lower loss ⟹ Higher efficiency

5. Conclusions

- The highest power yet achieved for an S band transistor of 1900W has been reported
- A 2.7 – 3.1 GHz, 3kW pallet with 60% efficiency measuring just 2” x 5” has been reported
- Visit our booth 1018 for further details

Acknowledgements

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