MACOM Technology Solutions

Leading the Commercialization of GaN
Supporting Advanced Radar and Communication Systems

Weather Systems (MPAR)
Surveillance
AESA
Datalink / Ground Terminal
Marine Radar
Air Traffic Control
SATCOM
The GaN Landscape:

MACOM is Leading the Commercialization of GaN

**The GaN Landscape**

- GaN is a disrupting technology
- Continuous challenge to strike balance of size, weight and power (SWaP)
- Need to accommodate higher power in smaller packages

**MACOM & GaN**

- 90W, 50W and 15W GaN power in plastic
- Proven reliability with MACOM sophisticated thermal dissipation techniques
- 60 years of rich heritage in semiconductor process innovation, proprietary design expertise & deep understanding of customer applications
Understanding the GaN Opportunity

- GaN is the fastest growing segment of the $1.3B RF power transistor market
- GaN is expected to be approximately 25% of the overall RF power device market in 2016

Source: ABI Research
High Power RF GaN is Expected to be Adopted Across Many Market Segments

Aerospace & Defense (51%)

Networks (32%)

Standard Products (17%)

- General Purpose Transistors
- General Purpose MMICs
- ISM Applications
- LTE Macro
- LTE Small Cell
- CATV Infra.
- Wireless Backhaul
- Radar
- Satcom
- SSPA
- EW Jammer
- Avionics

Expected 2016 GaN TAM = $325M
L-Band and S-Band Radar Systems Require High Power Pallets or Modules

Existing systems often use Si BJT transistors and pallets

Next generation radars need smaller packaged power transistors to reduce size, weight and cost, while maintaining optimal performance and reliability.
Ceramic GaN

- Most RF GaN transistor packages use ceramic feed-throughs and metal heat-sinks
- Often the assembly is manual
High power GaN Can Now be Realized in Space-Saving Plastic Packaging

Automatic:
- die placement
- die attach
- wire-bond
- dispense of die coat
- over-mold

Results in *True SMT* assembly with MSL 1 moisture sensitivity level

90Wpk power transistor in 3 x 6 mm DFN package
Learning From other Applications Helps Guide Best Practices in Stress, Humidity and Temperature

GaN LED used in lighting and automotive applications

MACOM plastic packaging approach
Thermal Measurement of 90W Device Shows $T_j=113^\circ$C For 80°C Stage Temp

- All thermal data is done in tuner-based Evaluation board = lower PAE than tuned board

- A junction temperature of 113 deg C represents a very low risk when it comes to thermal reliability. The devices can operate at even higher temperatures

- The calculated MTTF at 200 deg C is roughly 600 years.

1ms pulse, 10% duty cycle
High Power GaN in Small Packages

Wide bandwidth (DC-3.5GHz) up to 90W GaN Transistors

- MAGX-000035-09000P (90W Peak Pulse Power)
- MAGX-000035-05000P (50W Peak Pulse Power)
- MAGX-000035-01500P (15W Peak Pulse Power)

3 x 6 mm dual-flat no-leads (DFN) package

ORDER NOW

Wide bandwidth (DC-4.0GHz) 5W GaN Transistor

2.5 x 4.5 mm small outline transistor(SOT-89) package

- MAGX-000040-00500P (5W)

NOW SAMPLING
High Power GaN in Small Packages
Fully matched multi-stage amplifier modules

Wide bandwidth (dc-3.5GHz) GaN Transistors

14 mm x 24 mm laminate module

2-stage S-Band Module
85W, 23dB gain, 55% efficiency

Ask us for details
Booth # 930

2-stage L-Band Module
90W, 32dB gain, 62% efficiency

14 mm x 24 mm laminate module

- MAMG-002735-085PSM
- MAMG-001214-090PSM
Space Saving Power!
Measured Results of L-Band GaN Module

- 100 W Pout
- 32 dB Power Gain
- 62% PAE
- 5 dB Pin Window
- 300us/10%

14 mm x 24 mm laminate module
MACOM has the Technology Expertise and Knowledge to Lead the Commercialization of GaN

- Adoption of GaN-based RF power transistors by many different market segments is rapidly expanding

- Customers are demanding smaller size, weight and cost while maintaining optimal performance and reliability

- High power GaN transistors in plastic meet the needs for future radars as final-stage or driver-stage amplifiers
THANK YOU!

Come see us at Booth #930

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