GaN Amplifier Pallet 2-Stage, 50 V, 250 W
2.7 - 3.1 GHz

MACOM PURE CARBIDE™

MAPC-P1010
Rev. V1

Features

- *MACOM PURE CARBIDE™* Amplifier Series
- Suitable for Linear & Saturated Applications
- CW & Pulsed Operation: 250 W Output Power
- Input and Output Matched to 50 Ohms
- High gain, 2-Stage Amplifier
- Integrated Bias Controller/Sequencer
- 50 V Operation
- 100% RF Tested

Applications

- S-Band RADAR

Description

The MAPC-P1010 is a 2-stage, 50 Ohm matched high power GaN on Silicon Carbide HEMT D-mode pallet amplifier suitable for 2.7 - 3.1 GHz frequency operation. The device supports pulsed operation with output power levels of 250 W (54 dBm).

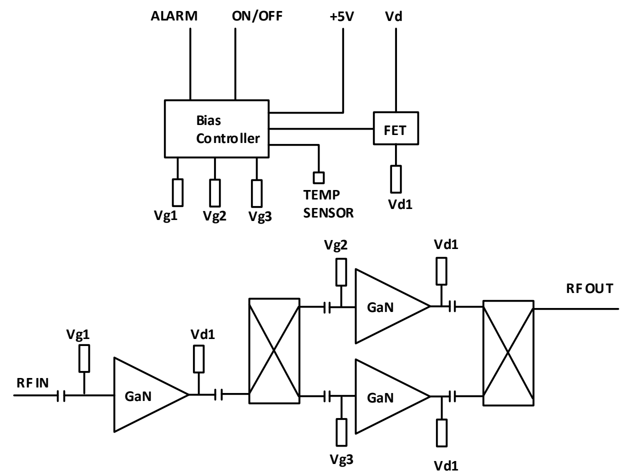
The MAPC-P1010 uses an on board bias controller which greatly simplifies system integration. The bias controller incorporates MACOM's proprietary Power Management IC (PMIC) which features full bias sequencing, temperature compensation, on/off control, and temperature alarm. A TTL High enables the pallet while a TTL Low turns it off.

Typical Performance:

- Measured at 2.5 dB compression, 100 µs pulse width, 10% duty cycle
- V_{DS} = 50 V, T_C = 25°C

Frequency (GHz)	Output Power (dBm)	Gain (dB)	η_D (%)
2.7	55.0	27.9	51.0
2.9	54.9	30.0	51.5
3.1	54.5	28.6	52.2

Functional Schematic



DC/Controller Pin Configuration

Pin #	Pin Name	Function
1, 2	V_D	Drain Voltage
3, 4, 5	GND	Ground
6	+5 V	Controller Supply
8	Alarm	Alarm Output
10	On/Off	Pallet Enable/Blank

RF Interface

Pin #	Pin Name	Function
11	RF_{IN}	RF Input
12	RF_{OUT}	RF Output
13, 14, 15, 16	GND	Ground

Ordering Information

Part Number	Configuration
MAPC-P1010-AB000	Microstrip RF Launch

RF Electrical Characteristics: T_C = 25°C, V_{DS} = 50 V
Note: Performance in MACOM Evaluation Test Fixture, 50 Ω system

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Small Signal Gain	Pulsed[1], 2.7 GHz, 2.9 GHz, 3.1 GHz	G_{SS}	—	29.0	—	dB
Power Gain	Pulsed[1], 2.5 dB Gain Compression 2.7 GHz 2.9 GHz 3.1 GHz	G_{SAT}	—	27.9 30.0 28.6	—	dB
Saturated Drain Efficiency	Pulsed[1], 2.5 dB Gain Compression 2.7 GHz 2.9 GHz 3.1 GHz	η_{SAT}	—	51.0 51.5 52.2	—	%
Saturated Output Power	Pulsed[1], 2.5 dB Gain Compression 2.7 GHz 2.9 GHz 3.1 GHz	P_{SAT}	—	55.0 54.9 54.5	—	dBm
Power Gain	Pulsed[1], P_{OUT} = 54 dBm, 2.7 GHz 2.9 GHz 3.1 GHz	G_P	—	29.6 31.5 30.0	—	dB
Drain Efficiency	Pulsed[1], P_{OUT} = 54 dBm, 2.7 GHz 2.9 GHz 3.1 GHz	η	—	46.5 47.0 50.5	—	%
Input Return Loss	Pulsed[1], P_{OUT} = 54 dBm, 2.7 GHz 2.9 GHz 3.1 GHz	IRL	—	-7.9 -9.4 -4.5	—	dB
Gain Flatness	Pulsed[1], P_{OUT} = 54 dBm, 2.7 - 3.1 GHz	ΔG	—	+/-1.5	—	dB
Phase Variation	Pulsed[1], P_{OUT} = 54 dBm, 2.7 - 3.1 GHz	$\Delta\phi$	—	+/-15	—	Deg
Ruggedness: Output Mismatch	All phase angles	Ψ	VSWR = 10:1, No Damage			

RF Electrical Specifications: T_A = 25°C, V_{DS} = 50 V
Note: Performance in MACOM Production Test Fixture, 50 Ω system

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Power Gain	Pulsed[1], P_{IN} = 27.0 dBm, 2.7 GHz Pulsed[1], P_{IN} = 25.0 dBm, 2.9 GHz Pulsed[1], P_{IN} = 26.0 dBm, 3.1 GHz	G_P	—	27.9 30.0 28.6	—	dB
Gain Flatness	Pulsed[1], P_{IN} = 15.0 dBm, 2.7 - 3.1 GHz	ΔG	—	+/- 1.5	—	dB
Drain Efficiency	Pulsed[1], P_{IN} = 27.0 dBm, 2.7 GHz Pulsed[1], P_{IN} = 25.0 dBm, 2.9 GHz Pulsed[1], P_{IN} = 26.0 dBm, 3.1 GHz	η	—	50.0 50.0 50.0	—	%
Input Return Loss	Pulsed[1], P_{IN} = 27.0 dBm, 2.7 GHz Pulsed[1], P_{IN} = 25.0 dBm, 2.9 GHz Pulsed[1], P_{IN} = 26.0 dBm, 3.1 GHz	IRL	—	- 4.5 - 4.5 - 4.5	—	dB

1. Pulse details: 100 µs pulse width, 10% duty cycle.

Absolute Maximum Ratings[2,3,4,5,6]

Parameter	Absolute Maximum
Output Power, P_{OUT}	57 dBm
Drain Source Voltage, V_{DS}	65 V
Storage Temperature Range	-40°C to +150°C
Case Operating Temperature Range	-40°C to +85°C
Channel Operating Temperature Range, T_{CH}	-40°C to +225°C
Absolute Maximum Channel Temperature	+250°C

2. Exceeding any one or combination of these limits may cause permanent damage to this device.
3. MACOM does not recommend sustained operation above maximum operating conditions.
4. Operating at drain source voltage $V_{DS} \leq 55$ V will ensure MTTF > 2×10^6 hours.
5. Operating at nominal conditions with $T_{CH} \leq 225°C$ will ensure MTTF > 2×10^6 hours.
6. MTTF may be estimated by the expression MTTF (hours) = $A\ e^{[B + C/(T+273)]}$ where T is the channel temperature in degrees Celsius, A = 1, B = -38.215, and C = 26,343.

RF Output Stage Thermal Characteristics[7]

Parameter	Test Conditions	Symbol	Typical	Units
Thermal Resistance using Finite Element Analysis	V_{DS} = 50 V, T_C = 85°C, T_{CH} = 225°C	R_θ(FEA)	4.63 (1st stage) 1.64 (2nd stage)	°C/W
Thermal Resistance using Infrared Measurement of Die Surface Temperature	V_{DS} = 50 V, T_C = 85°C, T_{CH} = 225°C	R_θ(IR)	3.70 (1st stage) 1.28 (2nd stage)	°C/W

7. Case temperature measured using thermocouple embedded in heat-sink. Contact local applications support team for more details on this measurement.

Handling Procedures

Please observe the following precautions to avoid damage:

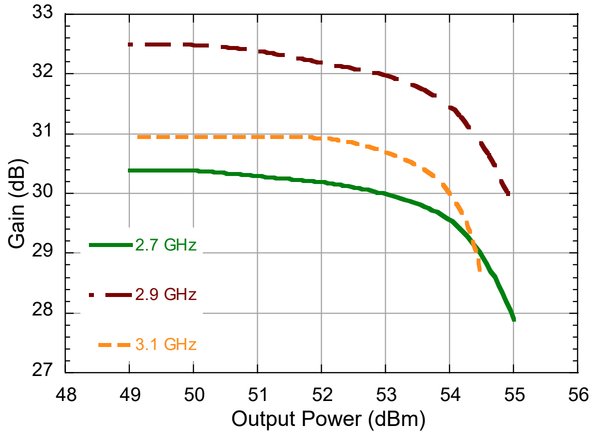
Static Sensitivity

Gallium Nitride Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

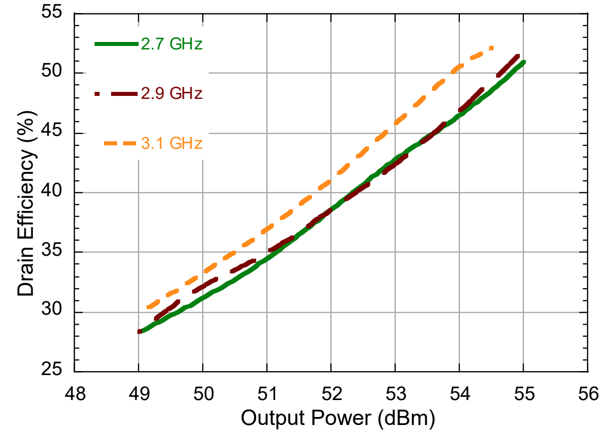
Typical Performance Curves

Pulsed[1], V_{DS} = 50 V, First Stage I_{DQ} = 100 mA, Second Stage I_{DQ} = 230 mA (each), T_C = 25°C

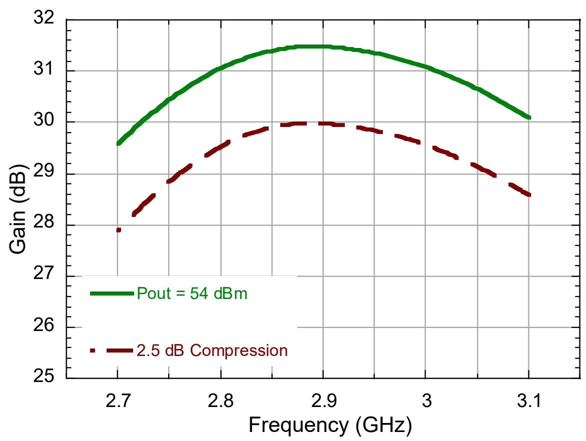
Gain vs. Output Power and Frequency



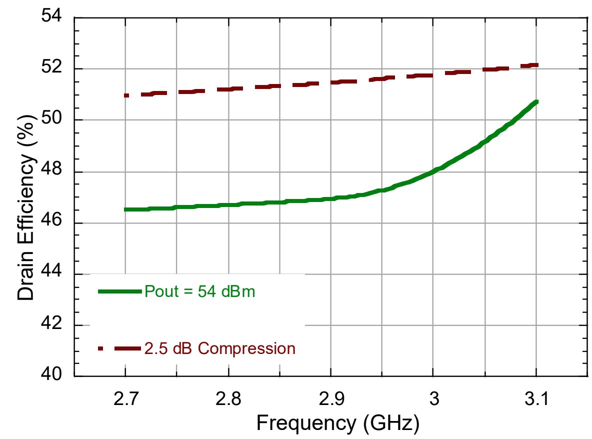
Drain Efficiency vs. Output Power and Frequency



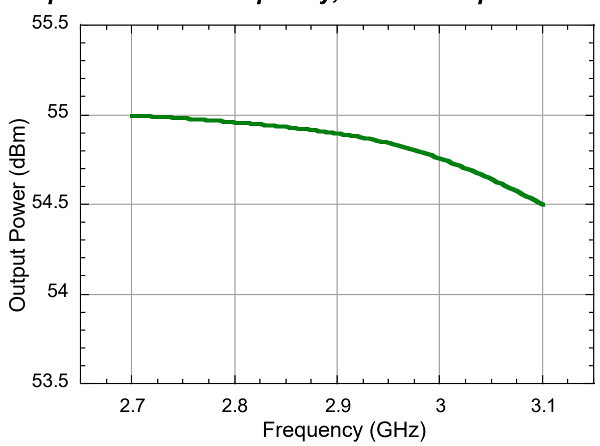
Gain vs. Frequency



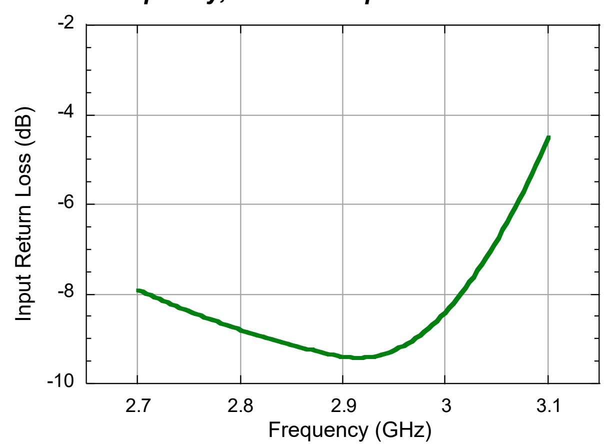
Drain Efficiency vs. Frequency



Output Power vs. Frequency, 2.5 dB Compression



IRL vs. Frequency, 2.5 dB Compression



Outline Drawing (unit : inch)