

GaN Amplifier Pallet 2-Stage, 50 V, 120 W 3.0 - 3.6 GHz



MACOM PURE CARBIDE™

MAPC-P1017

Rev. V1

Features

- MACOM PURE CARBIDE™ Amplifier Series
- Suitable for Linear & Saturated Applications
- Pulsed Operation: 120 W Output Power
- Input and Output Matched to 50 Ohms
- High gain, 2-Stage Amplifier
- 50 V Operation
- 100% RF Tested
- End-Use Statement Required

Applications

- S-Band RADAR

Description

The MAPC-P1017 is a 2-stage, 50 Ohm matched high power GaN on Silicon Carbide HEMT D-mode pallet amplifier suitable for 3.0 - 3.6 GHz frequency operation. This pallet includes isolator and dual directional coupler following 2nd stage amplifier. It supports pulsed operation.

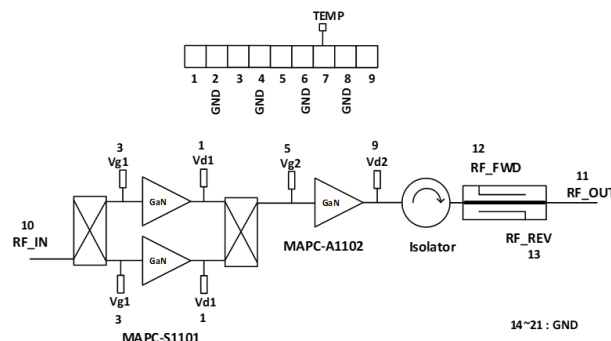
Typical Performance:

- Measured at 2.5 dB compression, 100 μ s pulse width, 10% duty cycle
- $T_C = 25^\circ\text{C}$, $V_{DS} = 50\text{ V}$,
First Stage $I_{DQ} = 80\text{ mA}$ (sum of 2 ea.),
Second Stage $I_{DQ} = 250\text{ mA}$.

Frequency (GHz)	Output Power (dBm)	Gain	η_D
		(dB)	(%)
3.0	51.5	28.4	39.7%
3.1	51.4	29.3	38.7%
3.2	51.3	30.6	39.8%
3.3	51.2	30.1	40.1%
3.4	51.3	30.1	41.1%
3.5	51.0	30.2	44.0%
3.6	49.8	30.3	44.8%

- Forward coupling: 32 +/- 1 dB
- Reverse coupling: 32 +/- 1 dB

Functional Schematic



DC/Controller Pin Configuration

Pin #	Pin Name	Function
1	Vd1	Drain Voltage for 1st stage
2,4,6,8	GND	Ground
3	Vg1	Gate Voltage for 1st stage
5	Vg2	Gate Voltage for 2nd stage
7	Temp	Temperature sensing
9	Vd2	Drain Voltage for 2nd stage

RF Interface

Pin #	Pin Name	Function
10	RF_IN	RF Input
11	RF_OUT	RF Output
12	RF_FWD	RF Forward coupling
13	RF_REV	RF Reverse coupling
14,15,16,17 18,19,20,21	GND	Ground

Ordering Information

Part Number	Configuration
MAPC-P1017-AB000	Microstrip RF Launch

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**RF Electrical Characteristics: Pulsed¹, T_C = +25°C, V_{DS} = 50 V,
First Stage I_{DQ} = 80 mA (sum of 2 ea.), Second Stage I_{DQ} = 250 mA
(Performance in MACOM Evaluation Test Fixture, 50 Ω system)**

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Small Signal Gain	3.0 GHz 3.3 GHz 3.6 GHz	G _{SS}	—	30.0	—	dB
Power Gain	2.5 dB Gain Compression, 3.0 GHz 3.3 GHz 3.6 GHz	G _{SAT}	—	28.4 30.1 30.3	—	dB
Saturated Drain Efficiency	2.5 dB Gain Compression, 3.0 GHz 3.3 GHz 3.6 GHz	η _{SAT}	—	39.7 40.1 44.8	—	%
Saturated Output Power	2.5 dB Gain Compression, 3.0 GHz 3.3 GHz 3.6 GHz	P _{SAT}	—	51.5 51.2 49.8	—	dBm
Power Gain	P _{OUT} = 49 dBm, 3.0 GHz 3.3 GHz 3.6 GHz	G _P	—	30.2 31.8 31.5	—	dB
Drain Efficiency	P _{OUT} = 49 dBm, 3.0 GHz 3.3 GHz 3.6 GHz	η	—	32.0 32.8 42.6	—	%
Input Return Loss	P _{OUT} = 49 dBm, 3.0 GHz 3.3 GHz 3.6 GHz	IRL	—	-16.1 -13.5 -10.1	—	dB
Gain Flatness	P _{OUT} = 49 dBm, 3.0 - 3.6 GHz	ΔG	—	+/-1	—	dB
Forward Coupling	P _{OUT} = 49 dBm, 3.0 - 3.6 GHz	RF _{FWD}	—	32	—	dB
Reverse Coupling	Power Input at RF Output Port = 10 dBm, 3.0 - 3.6 GHz	RF _{REV}	—	32	—	dB
Phase Variation	P _{OUT} = 49 dBm, 3.0 - 3.6 GHz	Δφ	—	+/-15	—	Deg.
Ruggedness: Output Mismatch	All phase angles	Ψ	VSWR = 10:1, No Damage			

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

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First Stage I_{DQ} = 80 mA (sum of 2 ea.), Second Stage I_{DQ} = 250 mA
(Performance in MACOM Evaluation Test Fixture, 50 Ω system)**

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Saturated Output Power	P _{IN} = 23.5 dBm, 3.0 GHz P _{IN} = 21.5 dBm, 3.3 GHz P _{IN} = 20.0 dBm, 3.6 GHz	P _{SAT}	—	51.0 50.7 49.3	—	dBm
Power Gain	P _{IN} = 23.5 dBm, 3.0 GHz P _{IN} = 21.5 dBm, 3.3 GHz P _{IN} = 20.0 dBm, 3.6 GHz	G _P	—	27.0 28.7 28.8	—	dB
Gain Flatness	P _{IN} = 10 dBm, 3.0 - 3.6 GHz	ΔG	—	+/-1.5	—	dB
Drain Efficiency	P _{IN} = 23.5 dBm, 3.0 GHz P _{IN} = 21.5 dBm, 3.3 GHz P _{IN} = 20.0 dBm, 3.6 GHz	η	—	37.7 38.1 42.8	—	%
Input Return Loss	P _{IN} = 23.5 dBm, 3.0 GHz P _{IN} = 21.5 dBm, 3.3 GHz P _{IN} = 20.0 dBm, 3.6 GHz	IRL	—	-8 -8 -8	—	dB
Forward Coupling	P _{OUT} = 49 dBm, 3.0 - 3.6 GHz	RF _{FWD}	31	32	33	dB
Reverse Coupling	Power Input at RF Output Port =10 dBm, 3.0 - 3.6 GHz	RF _{REV}	31	32	33	dB

Absolute Maximum Ratings^{2,3,4,5,6}

Parameter	Absolute Maximum
Output Power, P _{OUT}	53 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

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- MACOM does not recommend sustained operation above maximum operating conditions.
- Operating at drain source voltage V_{DS} ≤ 55 V will ensure MTTF > 2 x 10⁶ hours.
- Operating at nominal conditions with T_{CH} ≤ 225°C will ensure MTTF > 2 x 10⁶ hours.
- 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 = 1.03, B = -33.74, and C = 24.137 for 1st stage, A = 1, B = -38.215, and C = 26,343 for 2nd stage.

RF Output Stage Thermal Characteristics⁷

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)	9.0 (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)	7.2 (1st stage) 1.28 (2nd stage)	°C/W

- 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.

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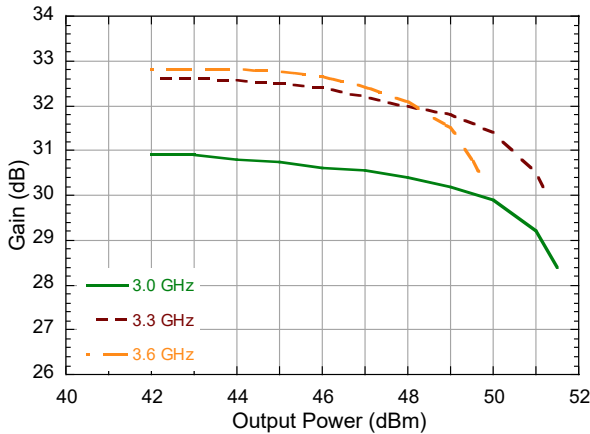
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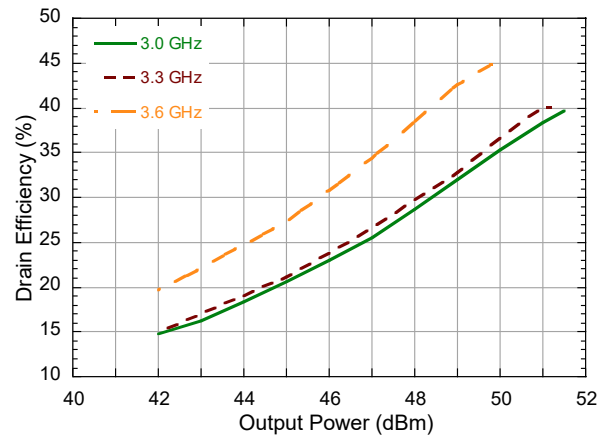
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**Typical Performance Curves: Pulsed¹, $T_C = +25^\circ\text{C}$, $V_{DS} = 50\text{ V}$,
First Stage $I_{DQ} = 80\text{ mA}$ (sum of 2 ea.), Second Stage $I_{DQ} = 250\text{ mA}$, $T_C = 25^\circ\text{C}$**

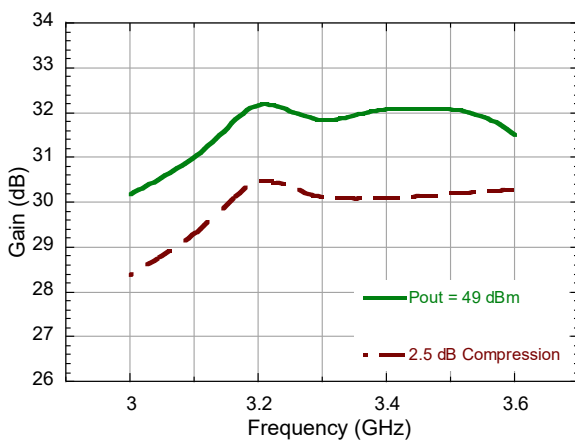
Gain vs. Output Power and Frequency



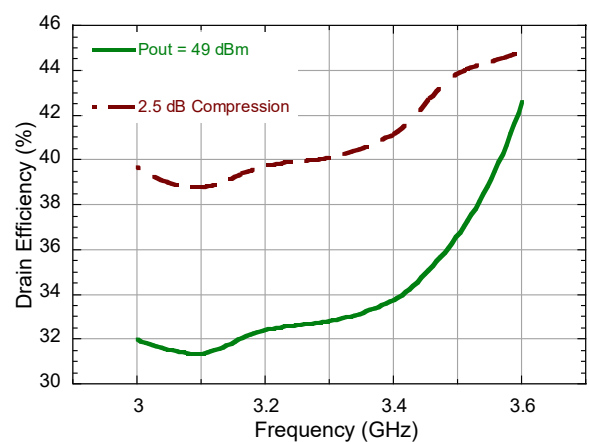
Drain Efficiency vs. Output Power and Frequency



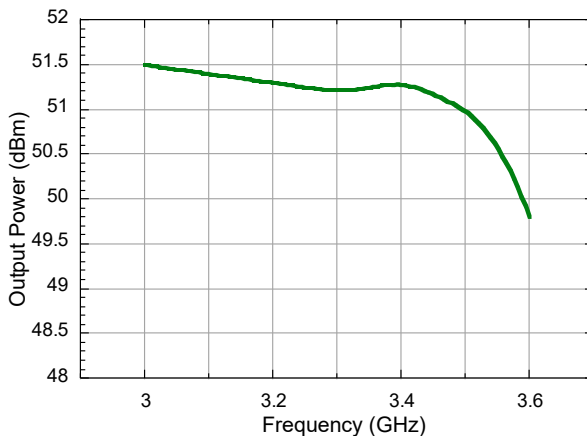
Gain vs. Frequency



Drain Efficiency vs. Frequency



Output Power vs. Frequency, 2.5dB Compression



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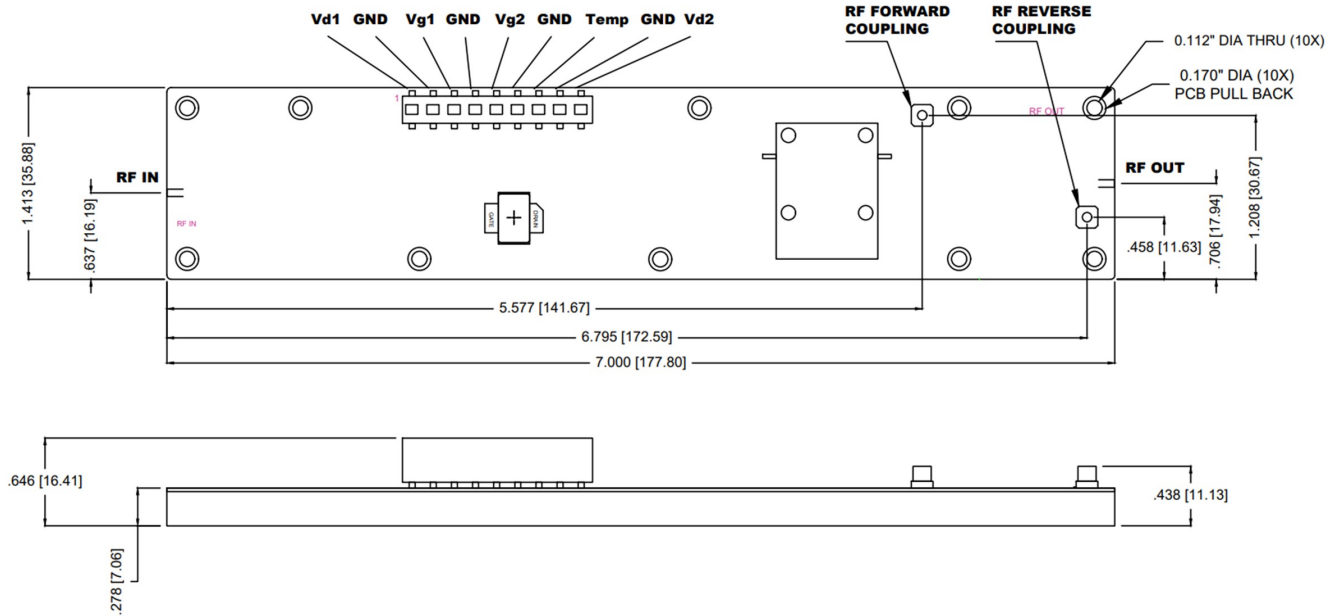


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Outline: (unit: inch [mm])



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