GaN Amplifier 50 V, 500 W
2.7 - 3.1 GHz

MACOM PURE CARBIDE™

CGHV31500F
Rev. V1

Features

- Saturated Power: 500 W
- Large Signal Gain: 12 dB
- Drain Efficiency: 65%
- Internally Matched: 50 Ω
- High Temperature Operation
- RoHS* Compliant

Applications

- General Amplification
- S-Band RADAR

Description

The CGHV31500F is a packaged amplifier fully matched to 50 ohms at both input and output ports. Utilizing the high performance, 0.4 um GaN on SiC production process, the CGHV31500F operates from 2.7 to 3.1 GHz and supports both defense and commercial related S-band radar applications.

Packaged in a thermally-enhanced, flange package, the CGHV31500F provides superior performance allowing customers to improve SWaP-C benchmarks in their next-generation systems

Typical RF Performance:

Measured in Evaluation Test Fixture[1] at P_{IN} = 46 dBm, 100 µsec pulse width and 10% Duty Cycle.

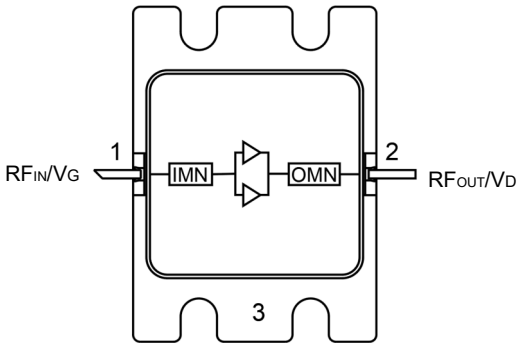
- V_{DS} = 50 V, I_{DQ} = 500 mA, T_C = 25°C

Frequency (GHz)	Output[1] Power (dBm)	Power[1] Gain (dB)	η_D[1] (%)
2.7	58.0	12.1	70
2.9	58.6	12.5	68
3.1	58.0	11.8	58

1. Performance values and curves in this data sheet were measured in this fixture.

440226

Functional Schematic



Pin Configuration

Pin #	Pin Name	Function
1	RF_{IN} / V_G	RF Input / Gate
2	RF_{OUT} / V_D	RF Output / Drain
3	Flange[2]	Ground / Source

2. The flange on the package bottom must be connected to RF, DC and thermal ground.

Ordering Information

Part Number	MOQ Increment
CGHV31500F	Bulk
CGHV31500F-AMP	Sample Board

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

RF Electrical Specifications: T_A = +25°C, V_{DS} = 50 V, I_{DQ} = 500 mA

Parameter	Units	Min.	Typ.	Max.	Conditions
Output Power at f = 2.7 GHz	W	473	630	—	V_{dd} = 50 V, I_{dq} = 500 mA, P_{in} = 46 dBm Pulse Width = 100 µs, Duty Cycle = 10%
Output Power at f = 2.9 GHz	W	555	725	—	
Output Power at f = 3.1 GHz	W	473	630	—	
Power Gain at f = 2.7 GHz	dB	—	12.1	—	
Power Gain at f = 2.9 GHz	dB	—	12.5	—	
Power Gain at f = 3.1 GHz	dB	—	11.8	—	
Drain Efficiency at f = 2.7 GHz	%	57	68	—	
Drain Efficiency at f = 2.9 GHz	%	54	67	—	
Drain Efficiency at f = 3.1 GHz	%	50	62	—	
Small-Signal Gain (S21)	dB	11.25	14.5	—	V_{dd} = 50 V, I_{dq} = 500 mA, P_{in} = -10 dBm
Input Return Loss (S11)	dB	—	-15	-5.25	
Output Return Loss (S22)	dB	—	-5	-3	
Ruggedness: Output Mismatch	Ψ	—	—	5:1	No damage at all phase angles, V_{dd} = 50 V, I_{dq} = 500 mA, P_{in} = 46 dBm Pulse width = 100 µs, Duty Cycle = 10%

Note: Final testing and screening for all amplifier sales is performed using the CGHV31500F-AMP

DC Electrical Characteristics T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 150 V	I_{DLK}	-	-	33.4	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{GLK}	-11.6	-	-	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 83.6 mA	V_T	-3.8	-3.0	-2.3	V
Gate Quiescent Voltage	V_{DS} = 50 V, I_D = 500 mA	V_{GSQ}	-	-2.7	-	V

Absolute Maximum Ratings[1,2]

Parameter	Absolute Maximum
Pulse Width	500 µsec
Duty Cycle	10 %
Drain-Source Voltage	150 V
Gate Voltage	-10, +2 V
DC Drain Current	8.4 A
Gate Current	80 mA
Input Power	48 dBm
Storage Temperature	-65°C to +150°C
Mounting Temperature[3]	+245°C
Junction Temperature[4,5]	+225°C
Operating Temperature	-40°C to +125°C

1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. MACOM does not recommend sustained operation near these survivability limits.
3. Mounting temperature for 30 seconds.
4. Operating at nominal conditions with $T_J \leq +225$ C will ensure MTTF > 1 x 10^6 hours.
5. Junction Temperature (T_J) = T_C + Θjc * (V * I)
   Typical thermal resistance (Θjc) = 0.22 °C/W for CW.
   a) For T_C = +85°C,
   T_J = 168 °C @ P_{diss}=376 W

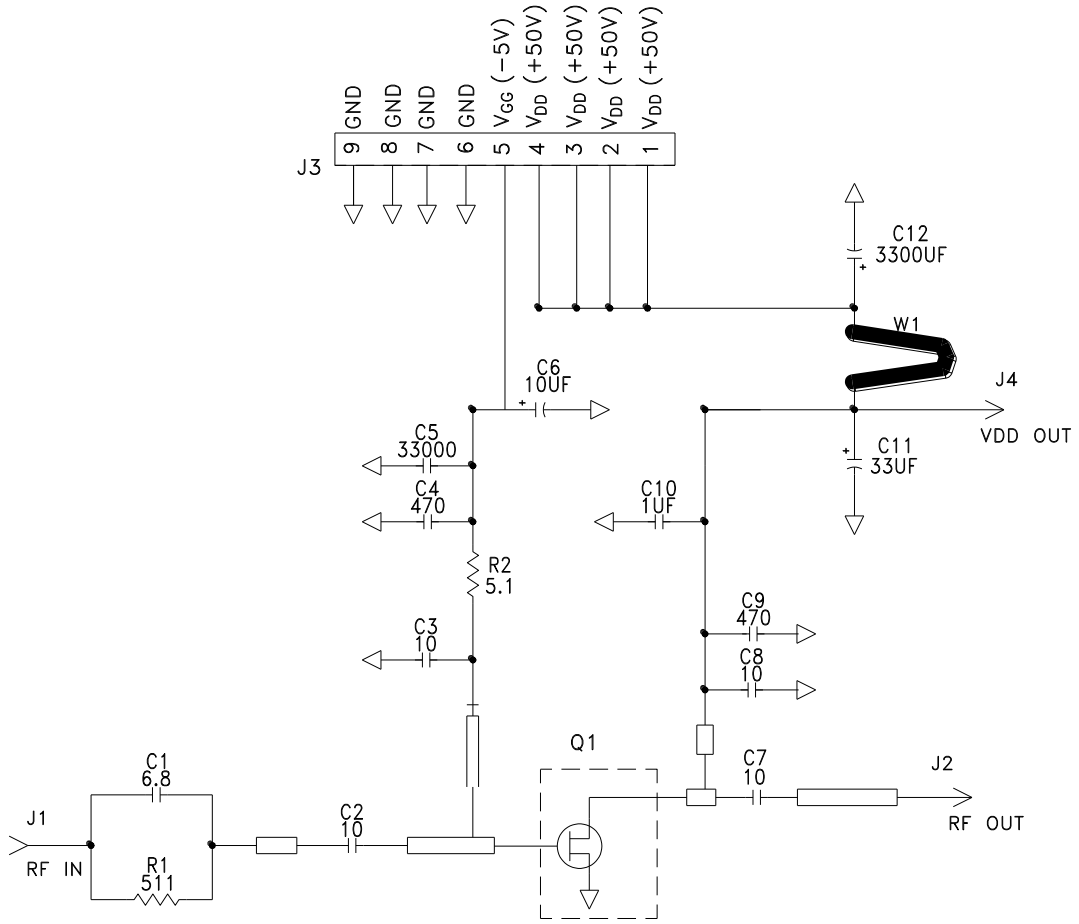
Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

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

Evaluation Test Fixture and Recommended Tuning Solution, 2.7 - 3.1 GHz



Description

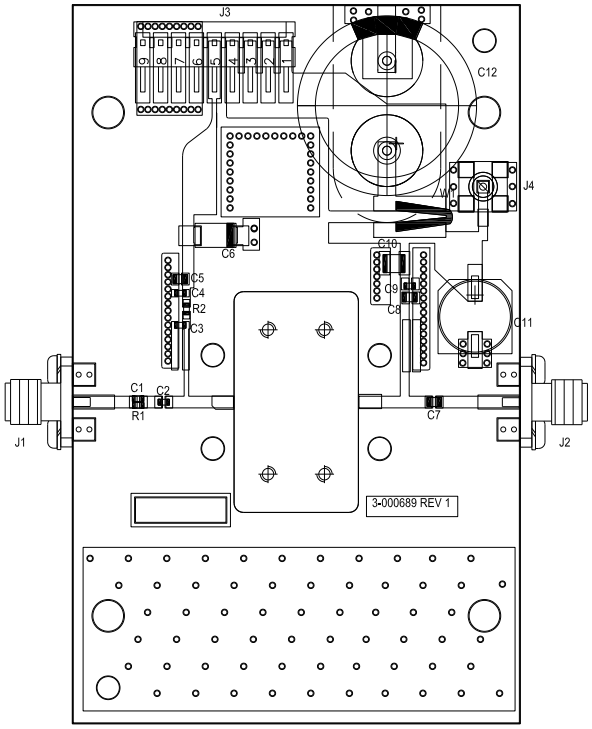
Parts measured on evaluation board (30-mil thick RF35). Matching is provided using a combination of lumped elements and transmission lines as shown in the simplified schematic above. Recommended tuning solution component placement, transmission lines, and details are shown on the next page.

Biasing Sequence

Bias ON
1. Ensure RF is turned off
2. Apply pinch-off voltage of -5 V to the gate
3. Apply nominal drain voltage
4. Bias gate to desired quiescent drain current
5. Apply RF

Bias OFF
1. Turn RF off
2. Apply pinch-off voltage of -5 V to the gate
3. Turn-off drain voltage
4. Turn-off gate voltage

Evaluation Test Fixture and Recommended Tuning Solution, 2.7—3.1 GHz



Assembly Parts List

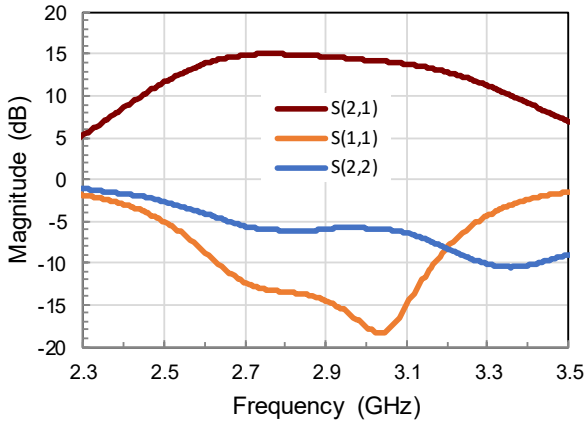
Reference Designator	Description	Qty
R1	RES, 511, OHM, +/- 1%, 1/16W, 0603	1
R2	RES, 5.1, OHM, +/- 1%, 1/16W, 0603	1
C1	CAP, 6.8pF, +/-0.25%, 250V, 0603	1
C2, C7, C8	CAP, 10.0pF, +/-1%, 250V, 0805	3
C3	CAP, 10.0pF, +/-5%, 250V, 0603	1
C4, C9	CAP, 470pF, 5%, 100V, 0603, X	2
C5	CAP, 33000 pF, 0805, 100V, X7R	1
C6	CAP, 10uF 16V TANTALUM	1
C10	CAP, 1.0uF, 100V, 10%, X7R, 1210	1
C11	CAP, 33uF, 20%, G CASE	1
C12	CAP, 3300uF, +/-20%, 100V, ELECTROLYTIC	1
J1, J2	CONN, SMA, PANEL MOUNT JACK, FL	2
J3	HEADER, RT>PLZ, 0.1CEN LK 9POS	1
J4	CONNECTOR; SMB, Straight, JACK, SMD	1
W1	CABLE, 18 AWG, 4.2	1
—	PCB, RF35, 2.5 X 4.0 X 0.030	1
Q1	CGHV31500F	1

Typical Performance Curves as Measured in the 2.7– 3.1 GHz Evaluation Test Fixture

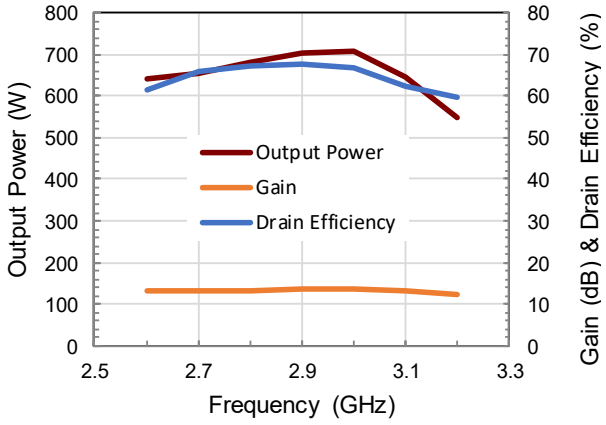
Pulse width = 100 µs, Duty Cycle = 10%, P_{IN} = 46 dBm, V_{DS} = 50V, I_{DQ} = 500 mA **(Unless otherwise noted)**

For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

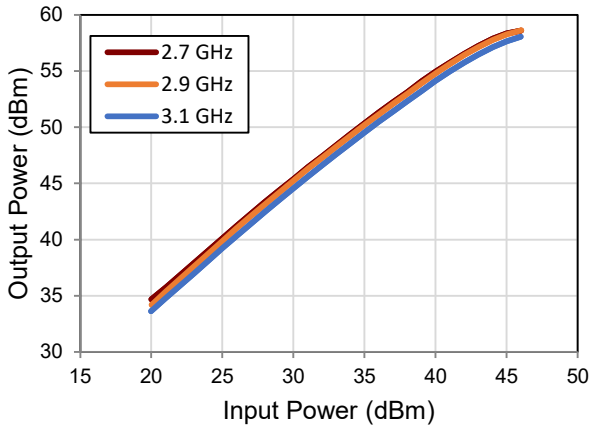
S11, S21, & S22 vs. Frequency



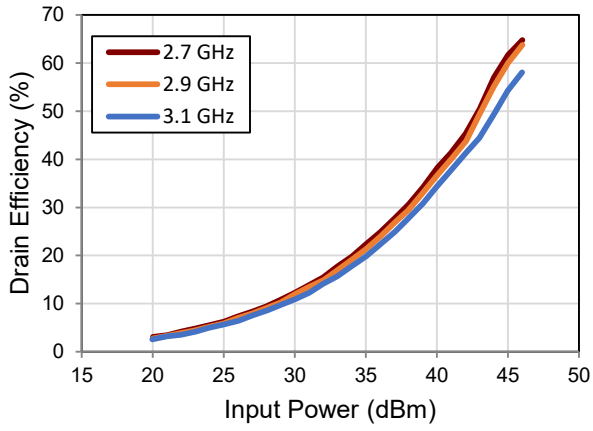
Output Power, Gain, Drain Efficiency vs. Frequency



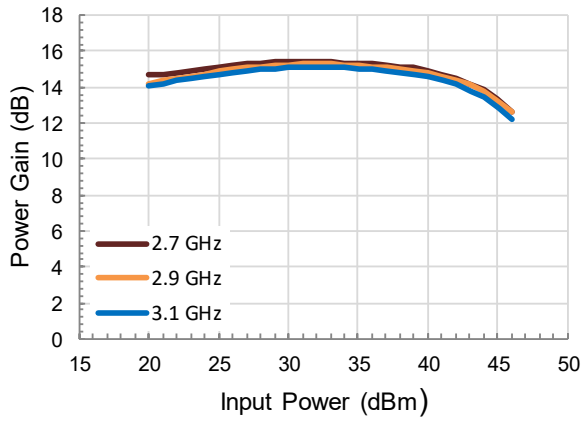
Output Power vs. Input Power and Frequency



Drain Efficiency vs. Input Power and Frequency

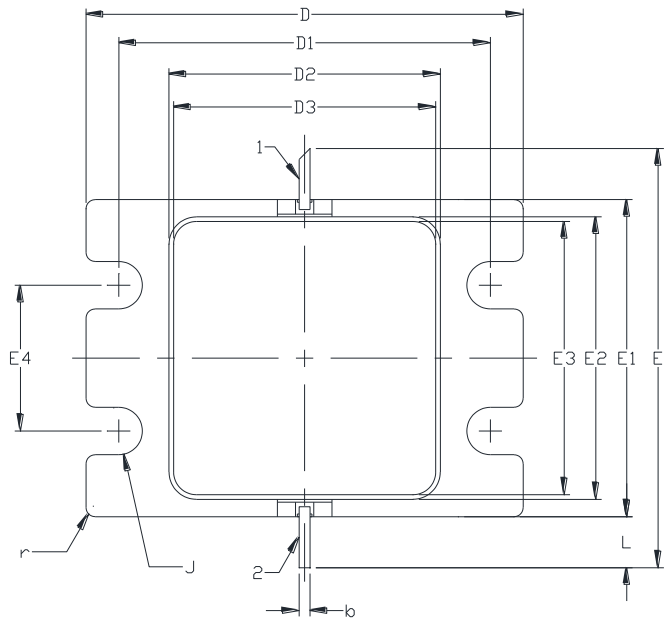


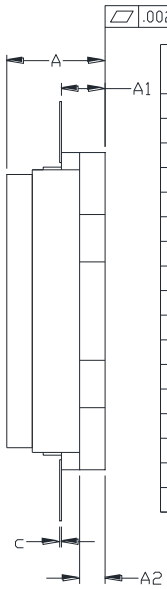
Power Gain vs. Input Power and Frequency



Lead-free 440226 Package Dimensions

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. INTERPRET DRAWING IN ACCORDANCE WITH ANSI Y14.5M-2009
2. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF .020 BEYOND EDGE OF LID
3. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF .008 IN ANY DIRECTION
4. ALL PLATED SURFACES ARE GOLD OVER NICKEL





1. GATE
2. DRAIN

DIM	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.205	0.221	5.21	5.61	
A1	0.088	0.100	2.24	2.54	2x
A2	0.049	0.061	1.24	1.55	
b	0.022	0.026	0.56	0.66	2x
c	0.003	0.006	0.08	0.15	
D	0.935	0.955	23.75	24.26	
D1	0.797	0.809	20.24	20.55	2x
D2	0.581	0.593	14.76	15.06	
D3	0.565	0.571	14.35	14.50	
E	0.906		23.01		REF
E1	0.679	0.691	17.25	17.55	
E2	0.604	0.616	15.34	15.65	
E3	0.588	0.594	14.93	15.09	
E4	0.309	0.321	7.85	8.15	2x
J	ø0.097	ø0.107	ø2.46	ø2.72	4x
L	0.090	0.130	2.29	3.30	2x
r	0.02 TYP		0.51 TYP		12x

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