Features

- Saturated Power: 180 W
- Large Signal Gain: 11.5 dB
- Drain Efficiency: 48%
- Internally Matched: 50 Ω
- High Temperature Operation
- RoHS* Compliant

Applications

- Troposcatter Communications
- Beyond Line of Sight—BLOS
- Satellite Communications

Description

The CGHV50200F is a gallium nitride (GaN) amplifier designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV50200F ideal for troposcatter communications, 4.4 - 5.0 GHz C-Band SatCom applications and Beyond Line of Sight.

The GaN HEMT is matched to 50 ohm, for ease of use. It is designed for CW, pulse, and linear mode of power amplifier operation. The amplifier is supplied in a ceramic/metal flange package, type 440217.

Typical RF Performance:

Measured in Evaluation Test Fixture¹ at 30 dBc, 1.6 MHz from carrier under OQPSK modulation, 1.6 Msps, PN23, Alpha Filter = 0.2

•	$V_{DS} = 40$	V. Ipo =	1 A.	Tc =	25°C
	VDS 10	v, DQ			20 0

Frequency (GHz)	Output ¹ Power (W)	Power ¹ Gain (dB)	η _⊳ ¹ (%)
4.4	100	11.4	49
4.6	100	11.6	47
4.8	126	11.0	48
5.0	101	11.8	48

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

440217

Functional Schematic



Pin Configuration

Pin #	Pin Name	Function
1	$\mathrm{RF}_{\mathrm{IN}}$ / 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
CGHV50200F	Bulk
CGHV50200F-AMP	Sample Board

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

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit www.macom.com for additional data sheets and product information.

1



CGHV50200F

Rev. V1





CGHV50200F

Rev. V1

Parameter Units Conditions Min. Тур. Max. Small Signal Gain at f = 4.4 GHz dB 14 15.4 V_{dd} =40V, I_{dq} = 1 A, P_{in} = 10 dBm Small Signal Gain at f = 4.8 GHz dB 14 15.3 Small Signal Gain at f = 5.0 GHz dB 14.25 15.2 _ Power Gain at f = 4.4 GHz dB 10.5 12.1 ____ Power Gain at f = 4.8 GHz 12.4 dB 10.5 Power Gain at f = 5.0 GHz dB 10.5 12.2 Power Added Efficiency at f = 4.4 GHz % 30 42 V_{dd} =40V, I_{dq} = 1 A, P_{out} = 48 dBm 1.6 Msps OQPSK Modulation, Power Added Efficiency at f = 4.8 GHz % 30 37 PN23, Alpha Filter = 0.2 Power Added Efficiency at f = 5.0 GHz % 30 40 OQPSK Linearity at 4.4 GHz dBc -29 -25 OQPSK Linearity at 4.8 GHz -34 -28 dBc OQPSK Linearity at 5.0 GHz dBc -34 -26 No damage at all phase angles, Ψ Ruggedness: Output Mismatch 3:1 ____ ____ V_{dd}=40V, I_{dq}= 1 A, CW P_{OUT} = 180 W

RF Electrical Specifications: $T_A = +25^{\circ}C$, $V_{DS} = 40 V$, $I_{DQ} = 1 A$

Note: Final testing and screening for all amplifier sales is performed using the CGHV50200F-AMP

DC Electrical Characteristics T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Тур.	Max.	Units
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 150 V	I _{DLK}	-	-	16.6	mA
Gate-Source Leakage Current	V _{GS} = -8 V, V _{DS} = 10 V	I _{GLK}	-5.8	-	-	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_{D} = 41.6 mA	VT	-3.8	-3.0	-2.3	V
Gate Quiescent Voltage	V _{DS} = 40 V, I _D = 1 A	V _{GSQ}	-	-2.7	-	V

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit www.macom.com for additional data sheets and product information.



CGHV50200F Rev. V1

Absolute Maximum Ratings^{1,2}

Parameter	Absolute Maximum
Drain-Source Voltage	150 V
Gate Voltage	-10, +2 V
DC Drain Current	14 A
Gate Current	41.6 mA
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.

MACOM does not recommend sustained operation near these survivability limits.

- 3. Mounting temperature for 30 seconds.
- Operating at nominal conditions with T_J ≤ +225 C will ensure MTTF > 1 x 10⁶ hours.
- 5. Junction Temperature $(T_J) = T_C + \Theta jc^* (V * I)$ Typical thermal resistance $(\Theta jc) = 0.81 \text{ °C/W}$ for CW.
 - a) For $T_c = +85^{\circ}C$,
 - T_J = 220 °C @ P_{diss}=166.4 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.

GaN Amplifier 40 V, 180 W 4.4 - 5.0 GHz



MACOM PURE CARBIDE

CGHV50200F Rev. V1

Evaluation Test Fixture and Recommended Tuning Solution, 4.4—5.0 GHz



Description

Δ

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

For further information and support please visit: <u>https://www.macom.com/support</u>

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.



CGHV50200F Rev. V1

Evaluation Test Fixture and Recommended Tuning Solution, 4.4-5.0 GHz



Assembly Parts List

Reference Designator	Description	Qty
R1	RES, 5.1, OHM, +/- 1%, 1/16W, 0603	1
C1, C6	CAP, 4.7pF, +/-1%, 250V, 0805	2
C2	CAP, 2.4pF, +/- 0.25pF, 250V, 0603	1
C3, C8	CAP, 470pF, 5%, 100V, 0603, X	2
C4, C9	CAP, 33000pF, 0805, 100V, X7R	2
C5	CAP 10µF 16V TANTALUM	1
C7	CAP, 2.0pF, +/-1%, 250V, 0805	1
C10	CAP, 1.0µF, 100V, 10%, X7R, 1210	1
C11	CAP, 33µF, 20%, G CASE	1
J1, J2	J1, J2 CONN, SMA, PANEL MOUNT JACK	2
J3	J3 HEADER RT>PLZ .1CEN LK 9POS	1
_	PCB, RF35, 2.5 X 3.0 X 0.030	1
_	2-56 SOC HD SCREW 1/4 SS	4
_	#2 SPLIT LOCKWASHER SS	4
Q1	CGHV50200F	1

⁵

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.

GaN Amplifier 40 V, 180 W 4.4 - 5.0 GHz



MACOM PURE CARBIDE

CGHV50200F

Rev. V1

Typical Performance Curves as Measured in the 4.4 – 5.0 GHz Evaluation Test Fixture

OQPSK modulation, 1.6 Msps, PN23, Alpha Filter = 0.2 , V_{DS} = 40V, I_{DQ} = 1 A **(Unless otherwise noted)** For Engineering Evaluation Only – This data does not Modify MACOM's Datasheet Limits.

S11, S21, & S22 vs. Frequency



Spectral Mask with PAVE = 48 dBm



Drain Current vs. Average Output Power



6

Output Power, Gain, Drain Efficiency vs. Frequency With Spectral Regrowth = -30 dBc



Gain, Spectral Regrowth and PAE vs. PAVE



MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.



CGHV50200F

Rev. V1

MACOM PURE CARBIDE

Typical Performance Curves as Measured in the 4.4 – 5.0 GHz Evaluation Test Fixture $V_{DS} = 40V$, $I_{DQ} = 1$ A (Unless otherwise noted)

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

IMD3 vs. Average Output Power

IMD vs. Average Output Power

Intermodulation (dBc)

-10

-20

-30

-40

-50

-60

-70

30 32 34 36 38

IMD5 4.4 GHz

IMD7 4.4 GHz

40 42 44

Average Output Power (dBm)

46 48 50 52



Two Tone Carrier Spacing Sweep at P_{AVE} = 48 dBm







CGHV50200F

Rev. V1

Typical Performance Curves as Measured in the 4.4 – 5.0 GHz Evaluation Test Fixture

Pulse width = 100 μ s, Duty Cycle = 10%, P_{IN} = 43 dBm, V_{DS} = 40V, I_{DQ} = 1 A (Unless otherwise noted)

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

Output Power, Gain and PAE vs. Frequency



IMD3 vs. Average Output Power



MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.



CGHV50200F

Rev. V1

MACOM PURE CARBIDE

Typical Performance Curves as Measured in the 4.4 – 5.0 GHz Evaluation Test Fixture $V_{DS} = 40V$, $I_{DQ} = 1$ A (Unless otherwise noted)

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





MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.

GaN Amplifier 40 V, 180 W 4.4 - 5.0 GHz



MACOM PURE CARBIDE

CGHV50200F Rev. V1

Lead-free 440217 Package Dimensions







CGHV50200F Rev. V1

MACOM Technology Solutions Inc. ("MACOM"). All rights reserved.

THESE MATERIALS ARE PROVIDED "AS IS" WITH NO WARRANTY OR LIABILITY, EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHT, ACCURACY OR COMPLETENESS, OR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.

These materials are provided in connection with MACOM's products as a service to its customers and may be used for informational purposes only. Except as provided in its Terms and Conditions of Sale or any separate agreement, MACOM assumes no liability or responsibility whatsoever, including for (i) errors or omissions in these materials; (ii) failure to update these materials; or (iii) conflicts or incompatibilities arising from future changes to specifications and product descriptions, which MACOM may make at any time, without notice. These materials grant no license, express or implied, to any intellectual property rights.

¹¹

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit <u>www.macom.com</u> for additional data sheets and product information.