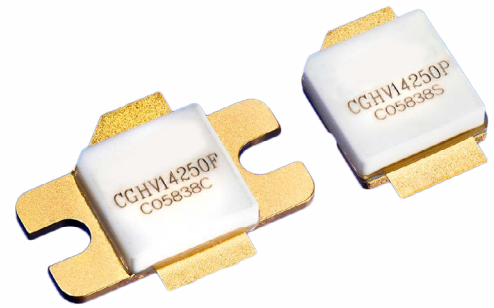


CGHV14250

250 W, DC - 1.6 GHz, GaN HEMT for L-Band Radar Systems

Description

The CGHV14250 is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV14250 ideal for DC - 1.6 GHz L-Band radar amplifier applications. The transistor could be utilized for band specific applications ranging from 0.9 through 1.8 GHz. The package options are ceramic/metal flange and pill package.



Package Types: 440162, 440161
PN: CGHV14250F, CGHV14250P

Typical Performance Over 1.2 - 1.4 GHz ($T_c = 25^\circ\text{C}$) of Demonstration Amplifier

Parameter	1.2 GHz	1.25 GHz	1.3 GHz	1.35 GHz	1.4 GHz	Units
Outdoor Power	365	365	350	310	330	W
Gain	18.6	18.6	18.4	17.9	18.2	dB
Drain Efficiency	80	80	77	74	76	%

Note: Measured in the CGHV14250-AMP amplifier circuit, under 500 μs pulse width, 10% duty cycle, $P_{IN} = 37$ dBm.

Features

- Reference design amplifier 1.2 - 1.4 GHz Operation
- FET Tuning range UHF through 1800 MHz
- 330 W Typical Output Power
- 18 dB Power Gain
- 77 % Typical Drain Efficiency
- < 0.3 dB Pulsed Amplitude Droop
- Internally pre-matched on input, unmatched output



Large Signal Models Available for ADS and MWO



Absolute Maximum Ratings (not simultaneous)

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DSS}	150	V	25°C
Gate-to-Source Voltage	V_{GS}	-10, +2		
Storage Temperature	T_{STG}	-65, +150	°C	
Operating Junction Temperature	T_J	225		
Maximum Forward Gate Current	I_{GMAX}	42	mA	25°C
Maximum Drain Current ¹	I_{DMAX}	18		
Soldering Temperature ²	T_S	245	°C	
Screw Torque	τ	40	in-oz	
CW Thermal Resistance, Junction to Case ³	$R_{\theta JC}$	0.95	°C/W	$P_{DISS} = 167 \text{ W}, 65^\circ\text{C}$
Pulsed Thermal Resistance, Junction to Case ³		0.57		$P_{DISS} = 167 \text{ W}, 500 \mu\text{sec}, 10\%, 85^\circ\text{C}$
Pulsed Thermal Resistance, Junction to Case ⁴		0.63		
Case Operating Temperature ⁵	T_C	-40, +130	°C	$P_{DISS} = 167 \text{ W}, 500 \mu\text{sec}, 10\%$

Notes:

¹ Current limit for long term, reliable operation

² Refer to the Application Note on soldering

³ Measured for the CGHV14250P

⁴ Measured for the CGHV14250F

⁵ See also, the Power Dissipation De-rating Curve on Page 5

Electrical Characteristics ($T_C = 25^\circ\text{C}$)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics¹						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V_{DC}	$V_{DS} = 10 \text{ V}, I_D = 41.8 \text{ mA}$
Gate Quiescent Voltage	$V_{GS(Q)}$	—	-2.7	—		$V_{DS} = 50 \text{ V}, I_D = 500 \text{ mA}$
Saturated Drain Current ²	I_{DS}	27.2	38.9	—	A	$V_{DS} = 6.0 \text{ V}, V_{GS} = 2.0 \text{ V}$
Drain-Source Breakdown Voltage	V_{BR}	125	—	—	V_{DC}	$V_{GS} = -8 \text{ V}, I_D = 41.8 \text{ mA}$
RF Characteristics³ ($T_C = 25^\circ\text{C}$, $F_0 = 1.4 \text{ GHz}$ unless otherwise noted)						
Output Power	P_{OUT}	260	300	—	W	$V_{DD} = 50 \text{ V}, I_{DQ} = 500 \text{ mA}, P_{IN} = 37 \text{ dBm}$
Drain Efficiency	D_E	70	77	—	%	
Power Gain	G_P	—	17.8	—	dB	
Pulsed Amplitude Droop	D	—	-0.3	—	dB	$V_{DD} = 50 \text{ V}, I_{DQ} = 500 \text{ mA}$
Output Mismatch Stress	VSWR	—	5 : 1	—	Y	No damage at all phase angles, $V_{DD} = 50 \text{ V}$, $I_{DQ} = 500 \text{ mA}, P_{IN} = 37 \text{ dBm}$ Pulsed
Dynamic Characteristics						
Input Capacitance	C_{GS}	—	150	—	pF	$V_{DS} = 50 \text{ V}, V_{GS} = -8 \text{ V}, f = 1 \text{ MHz}$
Output Capacitance	C_{DS}	—	16	—		
Feedback Capacitance	C_{GD}	—	1.35	—		

Notes:

¹ Measured on wafer prior to packaging

² Scaled from PCM data

³ Measured in CGHV14250-AMP. Pulsed Width = 500 μs , Duty Cycle = 10%.

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	TBD	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	TBD	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C

Typical Performance

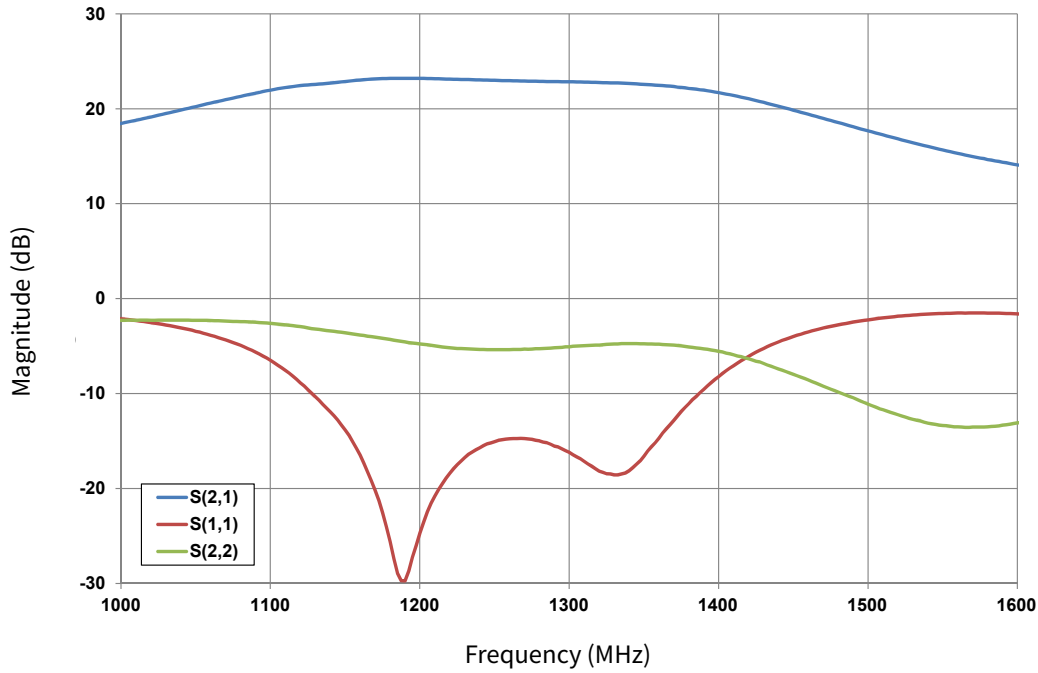


Figure 1. CGHV14250 Typical S Parameters
 $T_C = 25^\circ\text{C}$, $V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$

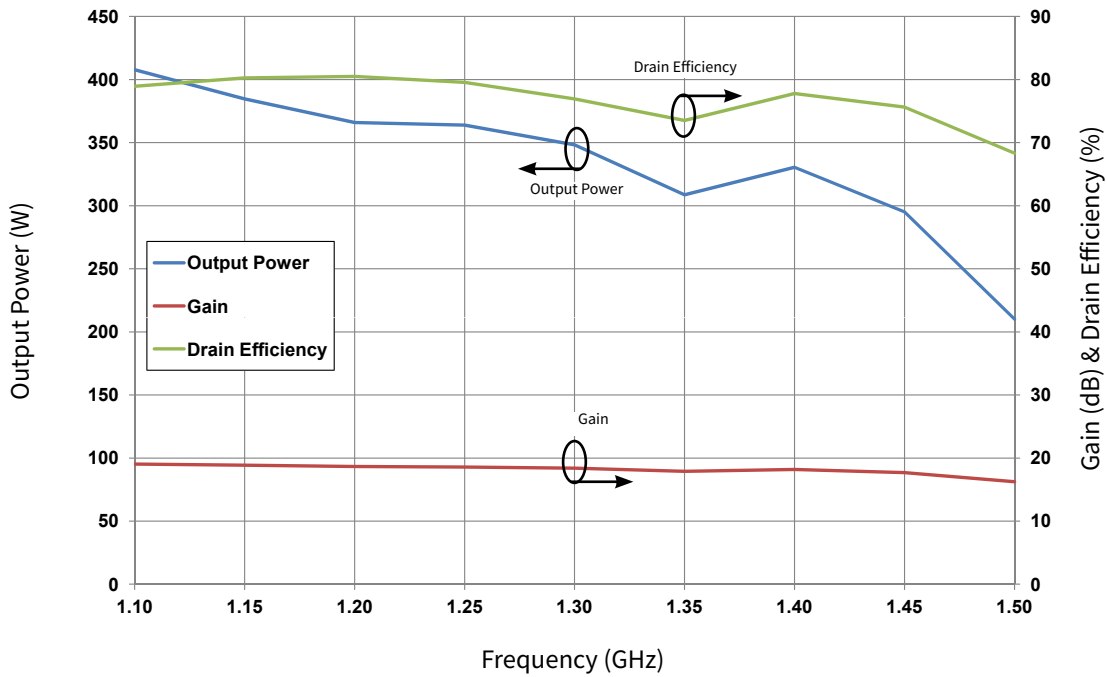


Figure 2. CGHV14250 Typical RF Results
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = 37\text{ dBm}$
 $T_C = 25^\circ\text{C}$, Pulse Width = 500 μs , Duty Cycle = 10%

Typical Performance

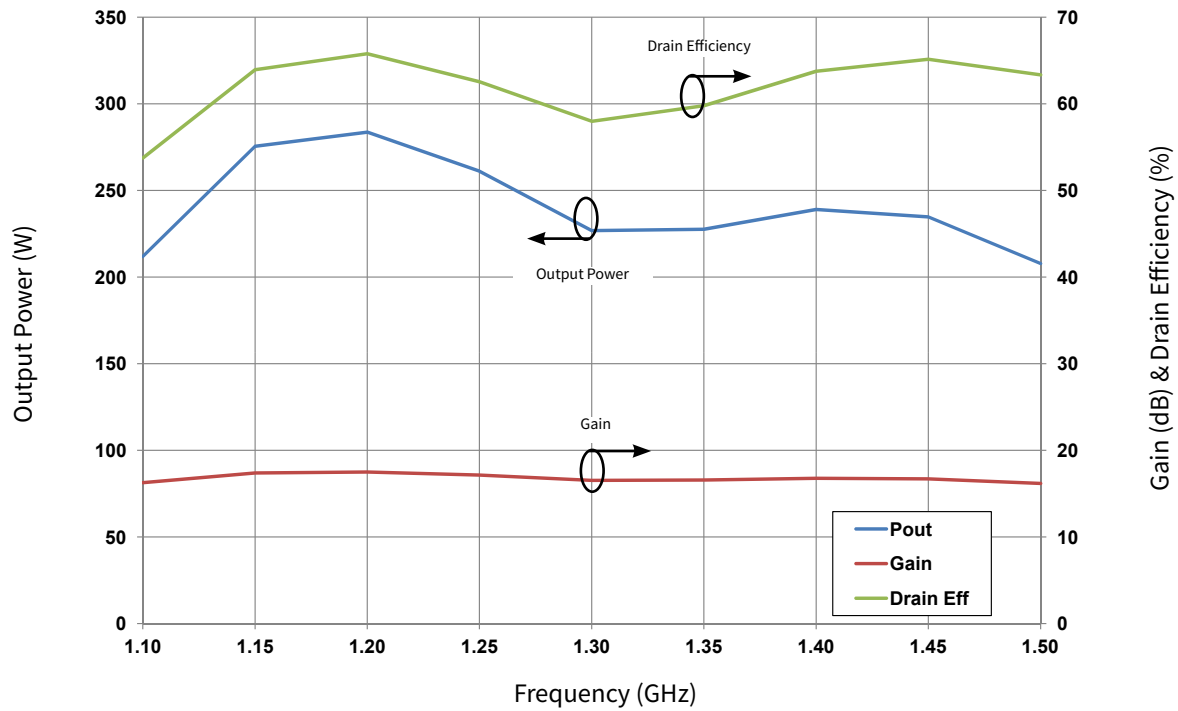
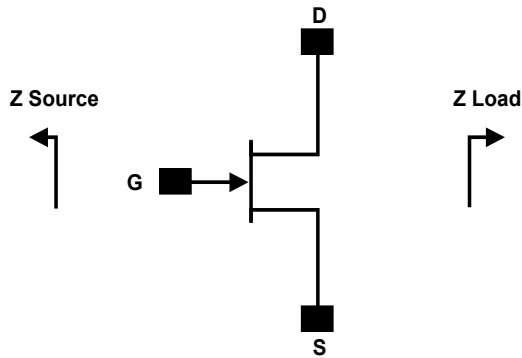


Figure 3. CGHV14250 CW RF Results
 $V_{DD} = 50 \text{ V}$, $I_{DQ} = 500 \text{ mA}$, $P_{IN} = 37 \text{ dBm}$, $T_C = 65^\circ\text{C}$

Source and Load Impedances

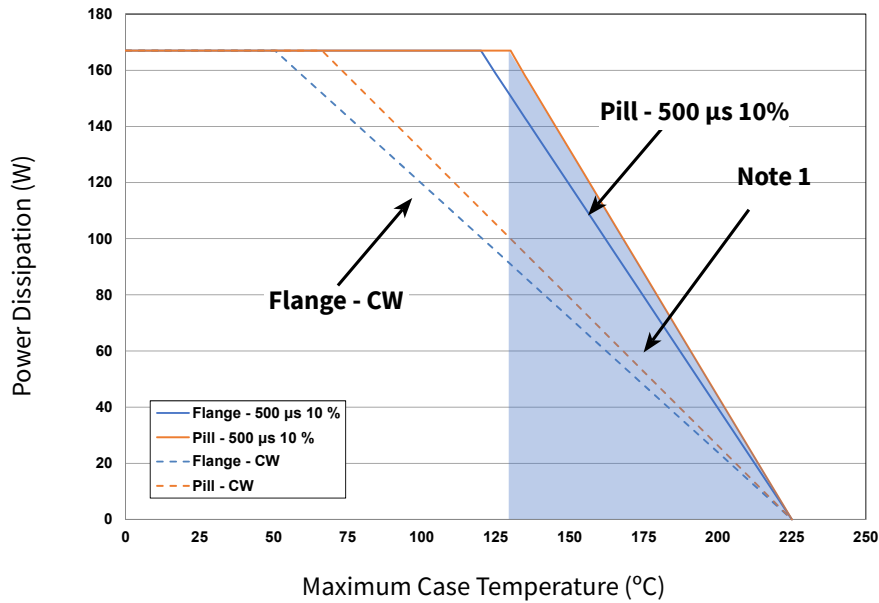


Frequency	Z Source	Z Load
900	0.6 - j0.3	5.3 + j0.1
1000	0.7 - j0.8	4.3 + j0.8
1100	1.3 - j1.1	3.3 + j0.8
1200	1.8 - j1.1	3.0 + j0.4
1300	2.5 - j0.7	2.5 + j0.4
1400	3.4 - j0.7	2.3 + j0.1
1500	1.8 - j0.9	2.3 + j0

Notes:

- ¹ $V_{DD} = 50\text{ V}$, $I_{PO} = 500\text{ mA}$ in the 440162 package
- ² Optimized for power gain, P_{SAT} and Drain Efficiency
- ³ When using this device at low frequency, series resistors should be used to maintain amplifier stability

CGHV14250F Power Dissipation De-rating Curve

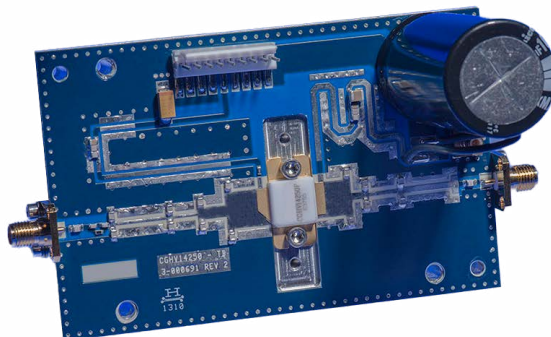


- Note:
¹ Area exceeds Maximum Case Operating Temperature (See Page 2)

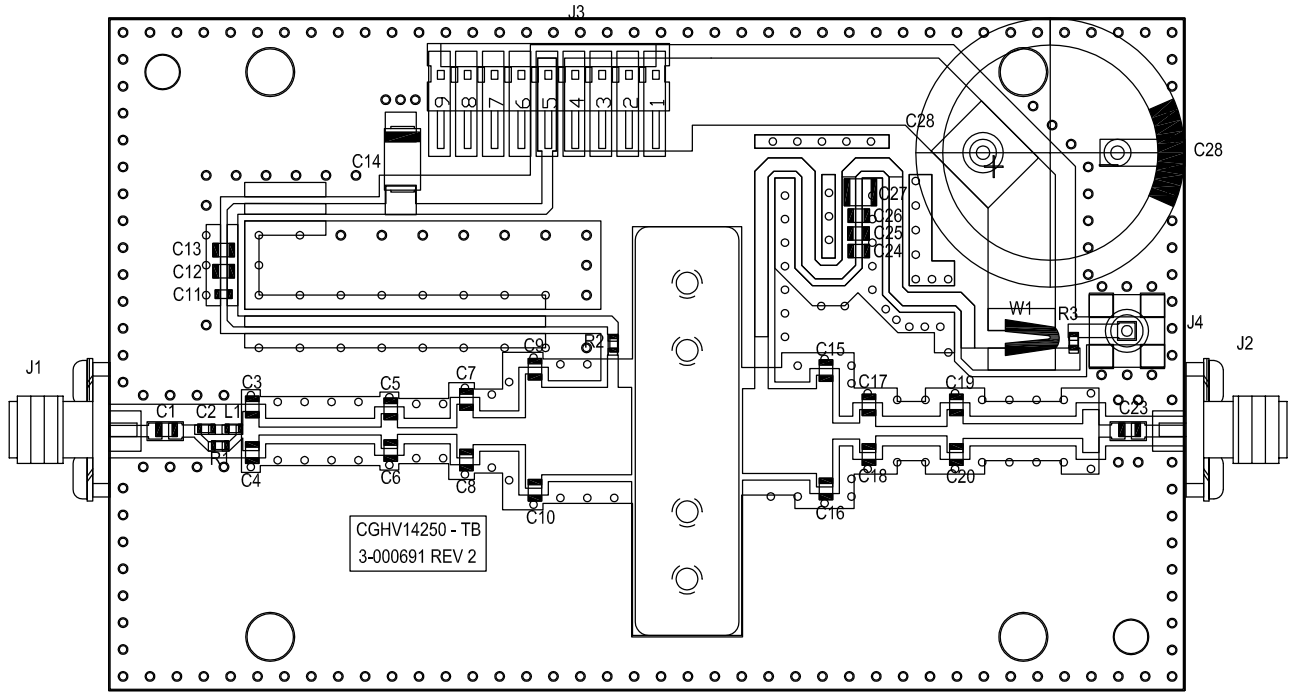
CGHV14250-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 1/16W, 0603, 1%, 562 ohms	1
R2	RES, 5.1 ohms, +/-1%, 1/16W, 0603	1
R3	RES, 1/16W, 0603, 1%, 4700 ohms	1
L1	INDUCTOR, CHIP, 6.8 nH, 0603 SMT	1
C1, C23	CAP, 27pF, +/- 5%, 250V, 0805, ATC 600F	2
C2	CAP, 2.0pF, +/- 0.1pF, 0603, ATC	1
C3, C4	CAP, 0.5pF, +/-0.05pF, 0805, ATC 600F	2
C5,C6	CAP, 1.0pF, +/-0.05 pF, 0805, ATC 600F	2
C7,C8,C9,C10	CAP, 3.0pF, +/-0.1pF, 250V, 0805, ATC 600F	4
C11,C24	CAP, 47pF,+/-5%, 250V, 0805, ATC 600F	2
C12,C25	CAP, 100pF, +/-5%, 250V, 0805, ATC 600F	2
C13,C26	CAP, 33000pF, 0805, 100V, X7R	2
C14	CAP, 10μF, 16V, TANTALUM	1
C15,C16,C17,C18	CAP, 3.9pF, +/-0.1pF, 250V, 0805, ATC 600F	4
C19,C20	CAP, 1.2pF, +/-0.05pF, 0805, ATC 600F	2
C27	CAP, 1.0μF, 100V, 10%, X7R, 1210	1
C28	CAP, 3300 μF, +/-20%, 100V, ELECTROLYTIC	1
J1,J2	CONN, SMA, PANEL MOUNT JACK, FL	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
J4	CONNECTOR ; SMB, Straight, JACK, SMD	1
W1	CABLE, 18 AWG, 4.2	1
-	PCB, RO4350, 0.020 MIL THK, CGHV14250, 1.2-1.4GHZ	1
Q1	CGHV14250	1

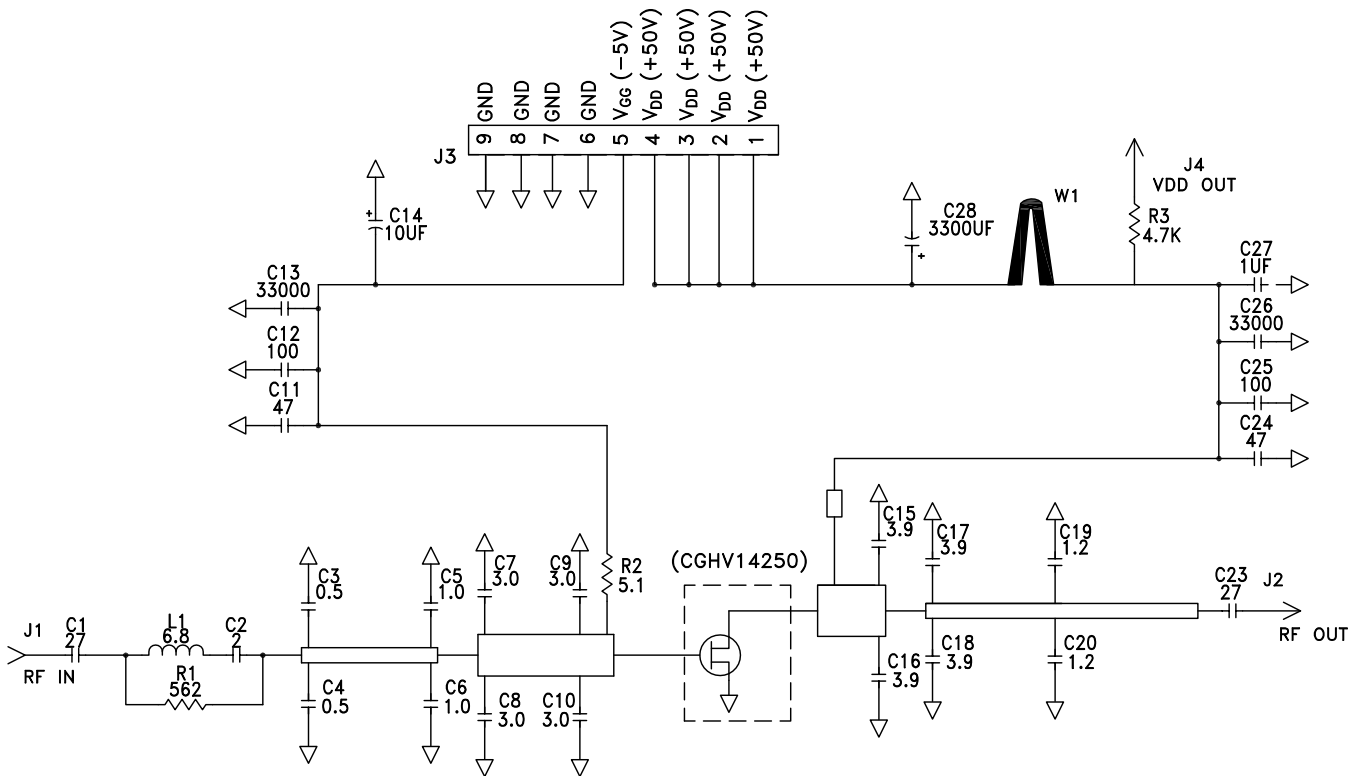
CGHV14250-AMP Demonstration Amplifier Circuit



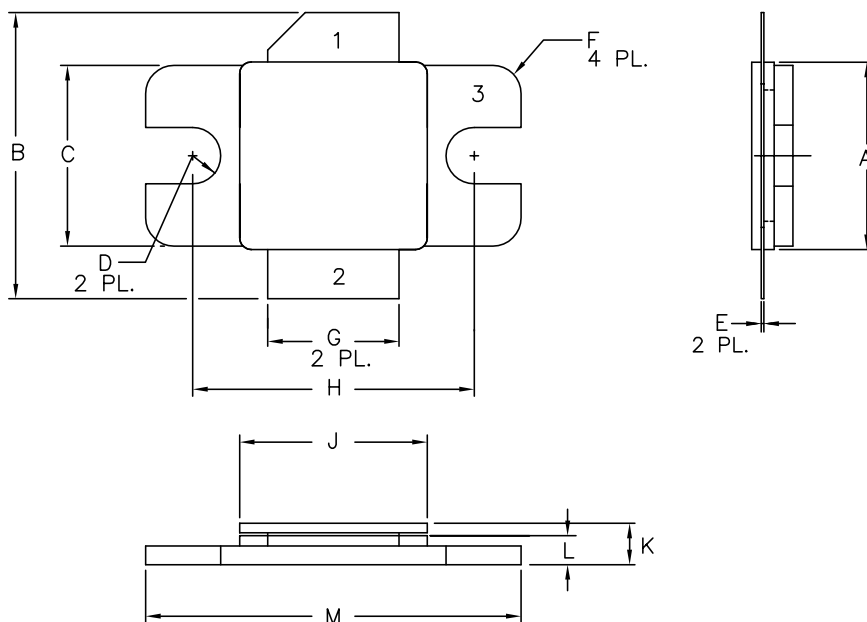
CGHV14250-AMP Demonstration Amplifier Circuit Outline



CGHV14250-AMP Demonstration Amplifier Circuit Schematic



Product Dimensions CGHV14250F (Package Type — 440162)



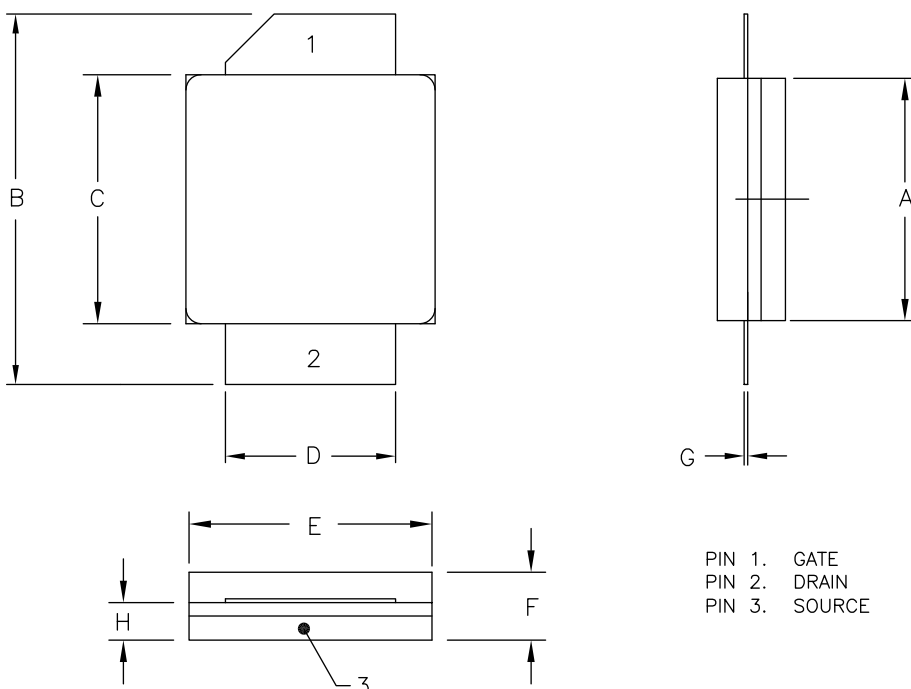
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
4. LID MAY BE MISALIGNED TO THE BODY OF THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.395	.405	10.03	10.29
B	.580	.620	14.73	15.75
C	.380	.390	9.65	9.91
D	.055	.065	1.40	1.65
E	.004	.006	0.10	0.15
F	.055	.065	1.40	1.65
G	.275	.285	6.99	7.24
H	.595	.605	15.11	15.37
J	.395	.405	10.03	10.29
K	.129	.149	3.28	3.78
L	.053	.067	1.35	1.70
M	.795	.805	20.19	20.45

- PIN 1. GATE
- PIN 2. DRAIN
- PIN 3. SOURCE

Product Dimensions CGHV14250P (Package Type — 440161)



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
4. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.395	.407	10.03	10.34
B	.594	.634	15.09	16.10
C	.395	.407	10.03	10.34
D	.275	.285	6.99	7.24
E	.395	.407	10.03	10.34
F	.129	.149	3.28	3.78
G	.004	.006	0.10	0.15
H	.057	.067	1.45	1.70

- PIN 1. GATE
- PIN 2. DRAIN
- PIN 3. SOURCE

Part Number System

CGHV14250F

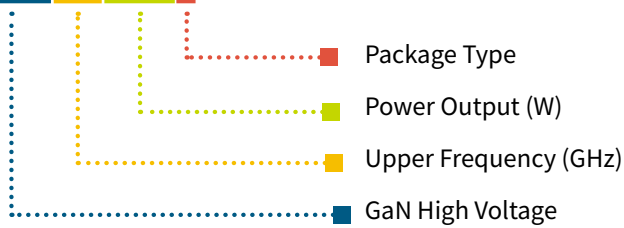


Table 1.

Parameter	Value	Units
Upper Frequency ¹	1.4	GHz
Power Output	250	W
Type	F = Flanged P = Package	—

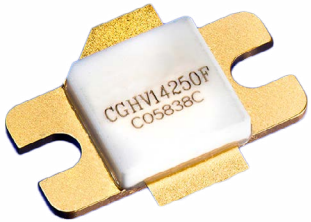

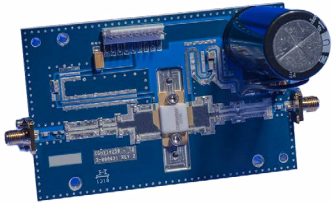
Note:

¹ Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

Table 2.

Character Code	Code Value
A	0
B	1
C	2
D	3
E	4
F	5
G	6
H	7
J	8
K	9
Examples:	1A = 10.0 GHz 2H = 27.0 GHz

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV14250F	GaN HEMT	Each	
CGHV14250P	GaN HEMT	Each	
CGHV14250F-AMP	Test board with GaN HEMT installed, 1.2 - 1.4 GHz	Each	

Notes & Disclaimer

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

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.

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.