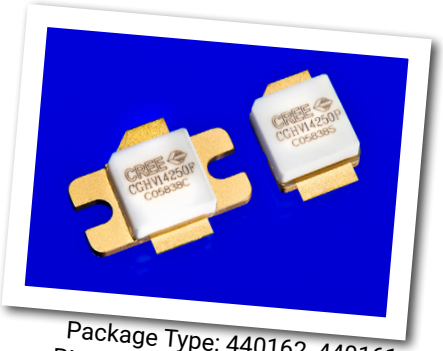
CGHV14250

250 W, 1200 - 1400 MHz, GaN HEMT for L-Band Radar Systems

Cree's 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 1.2 - 1.4 GHz L-Band radar amplifier applications. The transistor could be utilized for band specific applications ranging from 900 through 1800 MHz. The package options are ceramic/metal flange and pill package.



Package Type: 440162, 440161
PN: CGHV14250F, CGHV14250P

Typical Performance Over 1.2-1.4 GHz (T_C = 25°C) of Demonstration Amplifier

Parameter	1.2 GHz	1.25 GHz	1.3 GHz	1.35 GHz	1.4 GHz	Units
Output 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}	125	Volts	25˚C
Gate-to-Source Voltage	V_{GS}	-10, +2	Volts	25˚C
Storage Temperature	T_{STG}	-65, +150	˚C	
Operating Junction Temperature	T_J	225	˚C	
Maximum Forward Gate Current	I_{GMAX}	42	mA	25˚C
Maximum Drain Current[1]	I_{DMAX}	18	A	25˚C
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 W, 65˚C
Pulsed Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	0.57	˚C/W	P_{DISS} = 167 W, 500 µsec, 10%, 85˚C
Pulsed Thermal Resistance, Junction to Case[4]	$R_{\theta JC}$	0.63	˚C/W	P_{DISS} = 167 W, 500 µsec, 10%, 85˚C
Case Operating Temperature[5]	T_C	-40, +130	˚C	P_{DISS} = 167 W, 500 µsec, 10%

Note:
[1] Current limit for long term, reliable operation
[2] Refer to the Application Note on soldering at http://www.cree.com/rf/document-library
[3] Measured for the CGHV14250P
[4] Measured for the CGHV14250F
[5] See also, the Power Dissipation De-rating Curve on Page 5

Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1] (T_C = 25˚C)						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V_{DC}	V_{DS} = 10 V, I_D = 41.8 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	V_{DC}	V_{DS} = 50 V, I_D = 500 mA
Saturated Drain Current[2]	I_{DS}	31.4	37.6	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BR}	150	–	–	V_{DC}	V_{GS} = -8 V, I_D = 41.8 mA
RF Characteristics[3] (T_C = 25˚C, F_0 = 1.3 GHz unless otherwise noted)						
Output Power	P_{OUT}	275	330	–	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 37 dBm
Drain Efficiency	D_E	63	77	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 37 dBm
Power Gain	G_P	–	18.2	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 37 dBm
Pulsed Amplitude Droop	D	–	-0.3	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA
Output Mismatch Stress	VSWR	–	5 : 1	–	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 37 dBm Pulsed
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	150	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	16	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	1.35	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz

Notes:
[1] Measured on wafer prior to packaging.
[2] Scaled from PCM data.
[3] Measured in CGHV14250-AMP. Pulse Width = 500 µS, Duty Cycle = 10%.

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Typical Performance

Figure 1. - CGHV14250 Typical Sparameters
Tcase = 25°C V_{DD} = 50 V, I_{DQ} = 500 mA

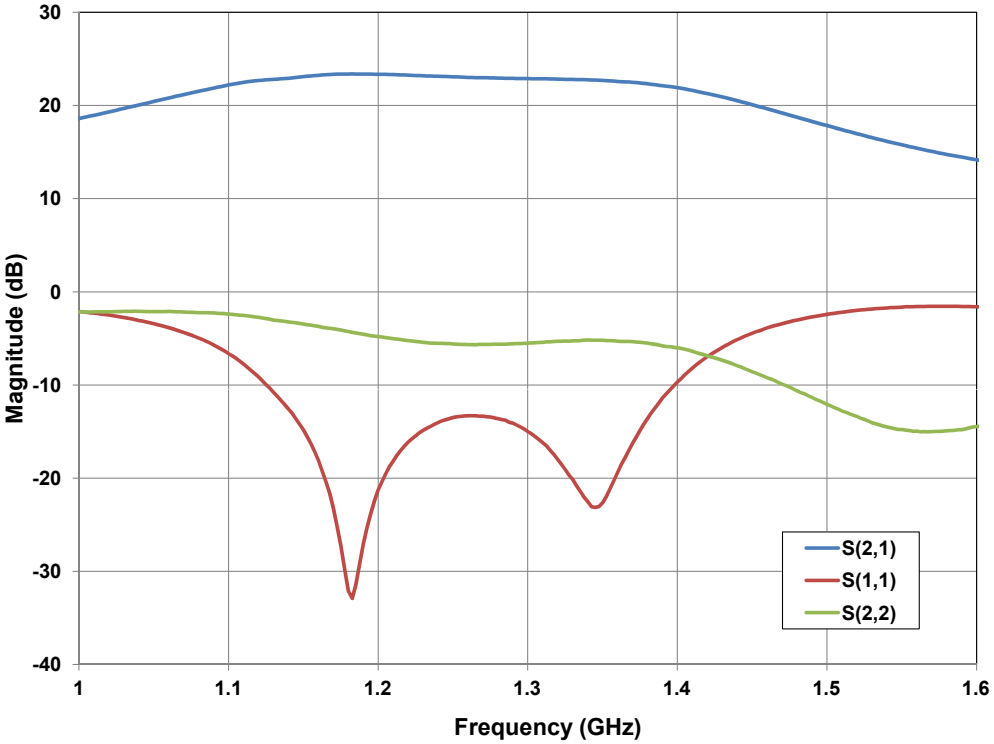
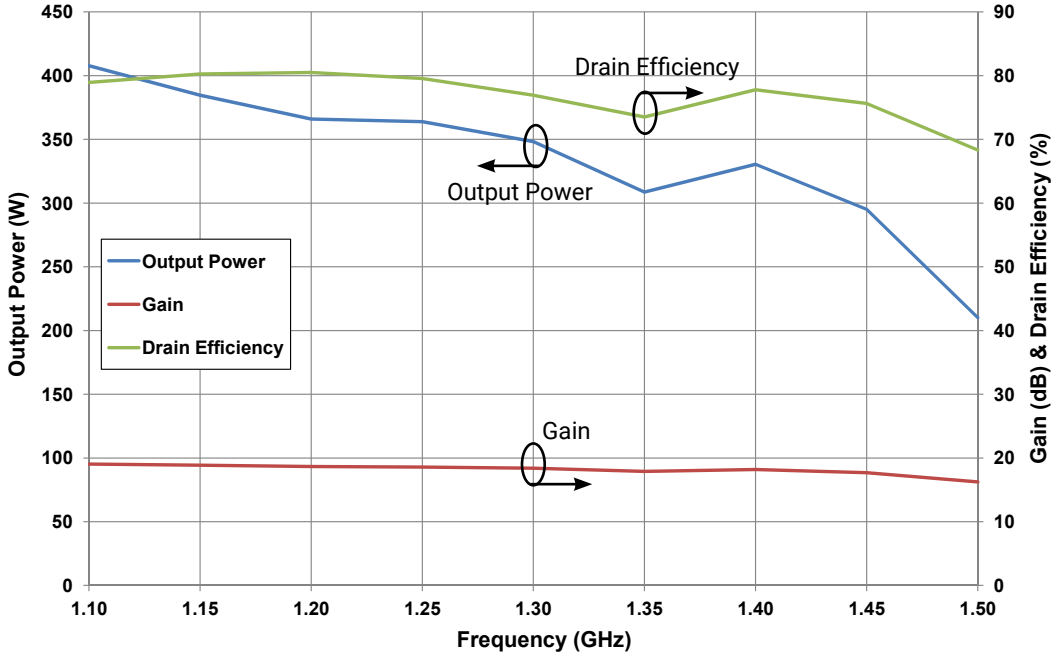


Figure 2. - CGHV14250 Typical RF Results
V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 37 dBm
Tcase = 25°C, Pulse Width = 500 µs, Duty Cycle = 10 %



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Typical Performance

Figure 3. - CGHV14250 Typical RF Results
V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 37 dBm
Tcase = 85°C, Pulse Width = 500 µs, Duty Cycle = 10 %

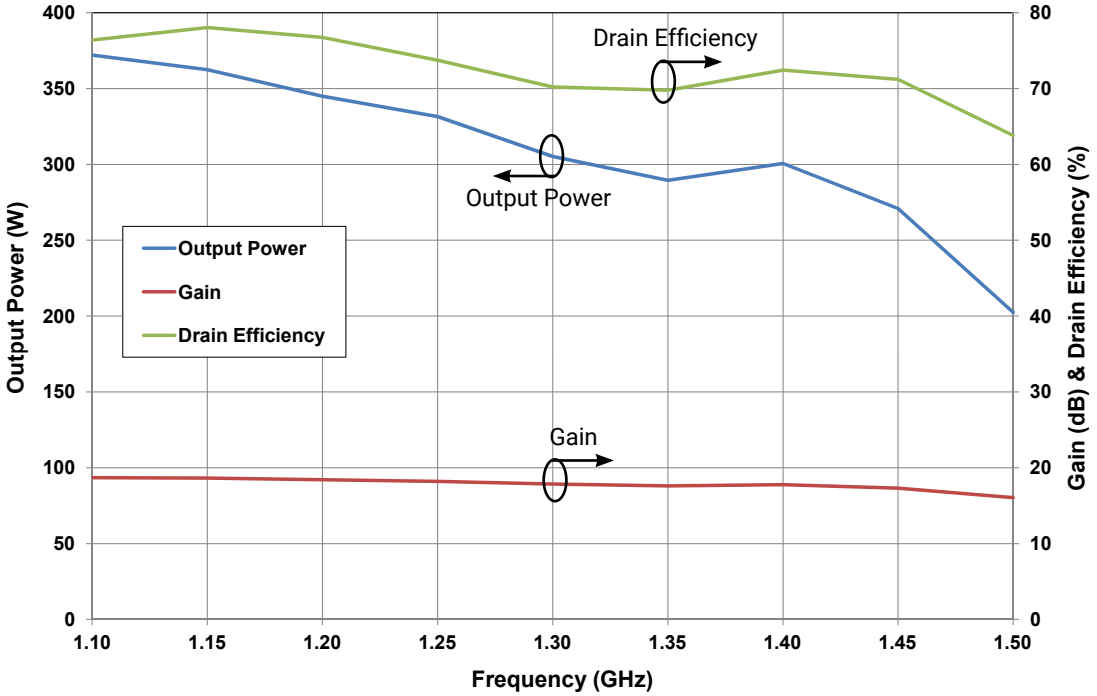
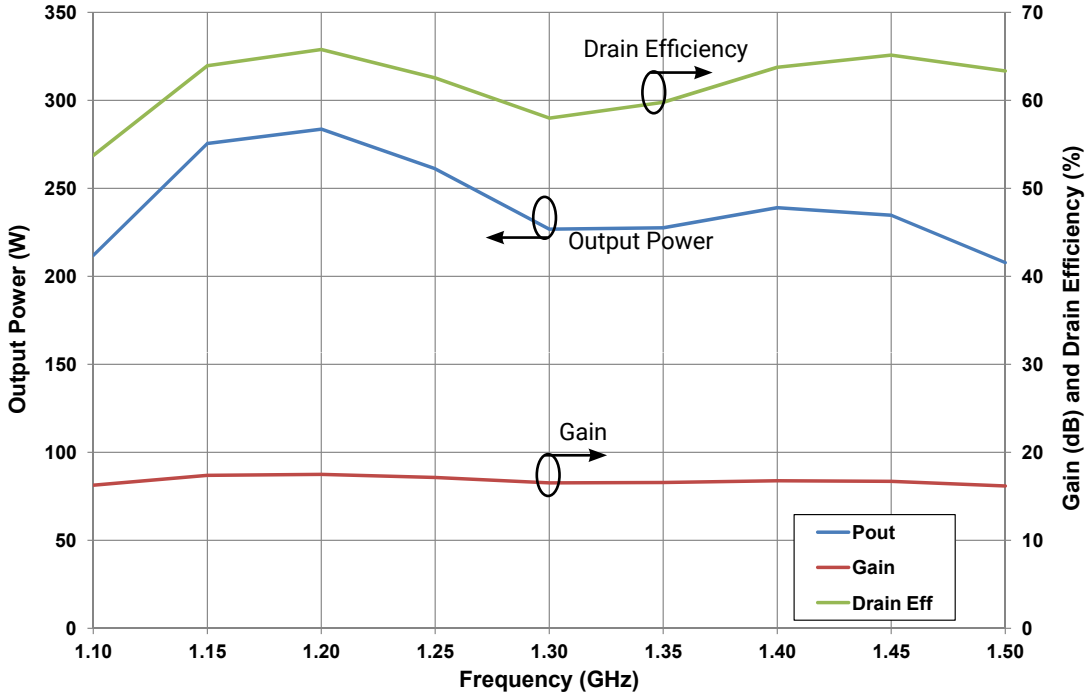


Figure 4. - CGHV14250 CW RF Results
V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 37 dBm, Tcase = 65°C



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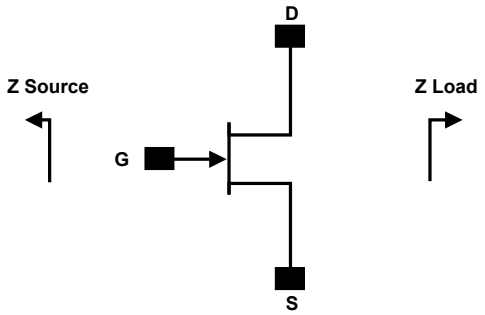
Source and Load Impedances

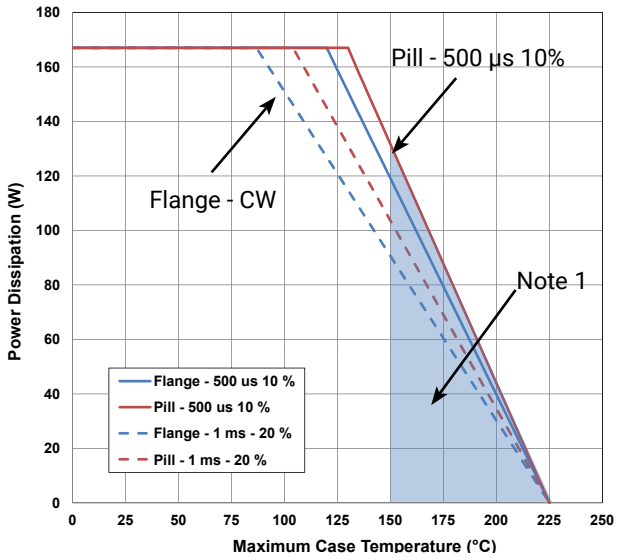


Frequency (MHz)	Z Source	Z Load
900	0.6 - j0.3	5.3 + j0.1
1000	0.7 - j0.8	4.3 +j0.8
1100	1.3 - j1.1	3.3 + j0.8
1200	1.8 - j1.1	3.0 + j0.4
1300	2.5 - j0.7	2.5 + j0.4
1400	3.4 - j0.7	2.3 + j0.1
1500	1.8 - j0.9	2.3 + j0

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

CGHV14250F Power Dissipation De-rating Curve

Figure 4. - CGHV14250 Transient Power Dissipation De-Rating Curve



Note 1. Area exceeds Maximum Case Temperature (See Page 2).

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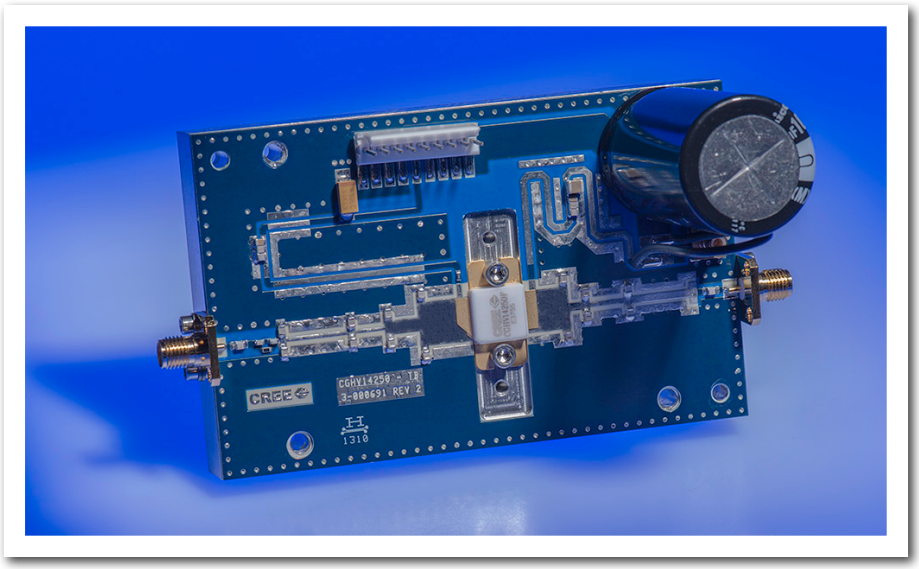
CGHV14250-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 1/16W, 0603, 1%, 562 OHMS	1
R2	RES, 5.1 OHM, +/-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 10uF 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, 1.0UF, 100V, 10%, X7R, 1210	1
C28	CAP, 3300 UF, +/-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



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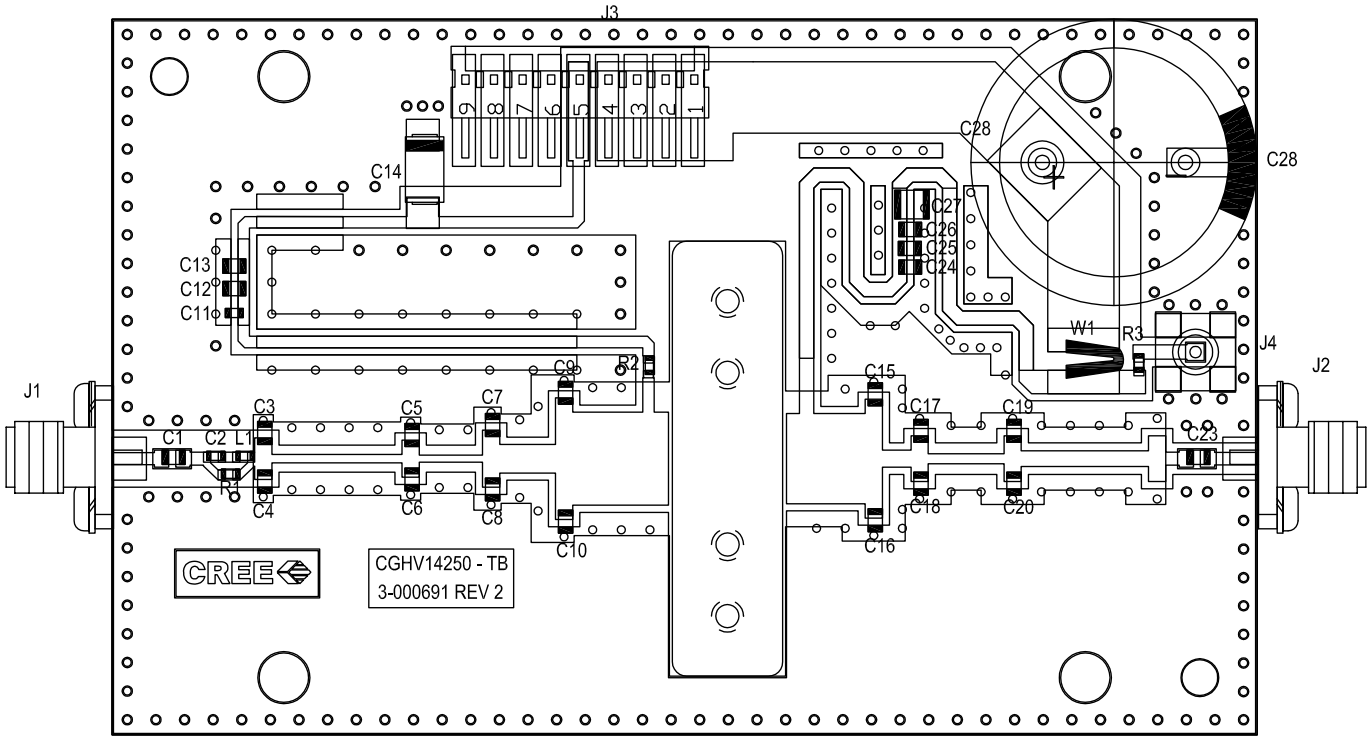
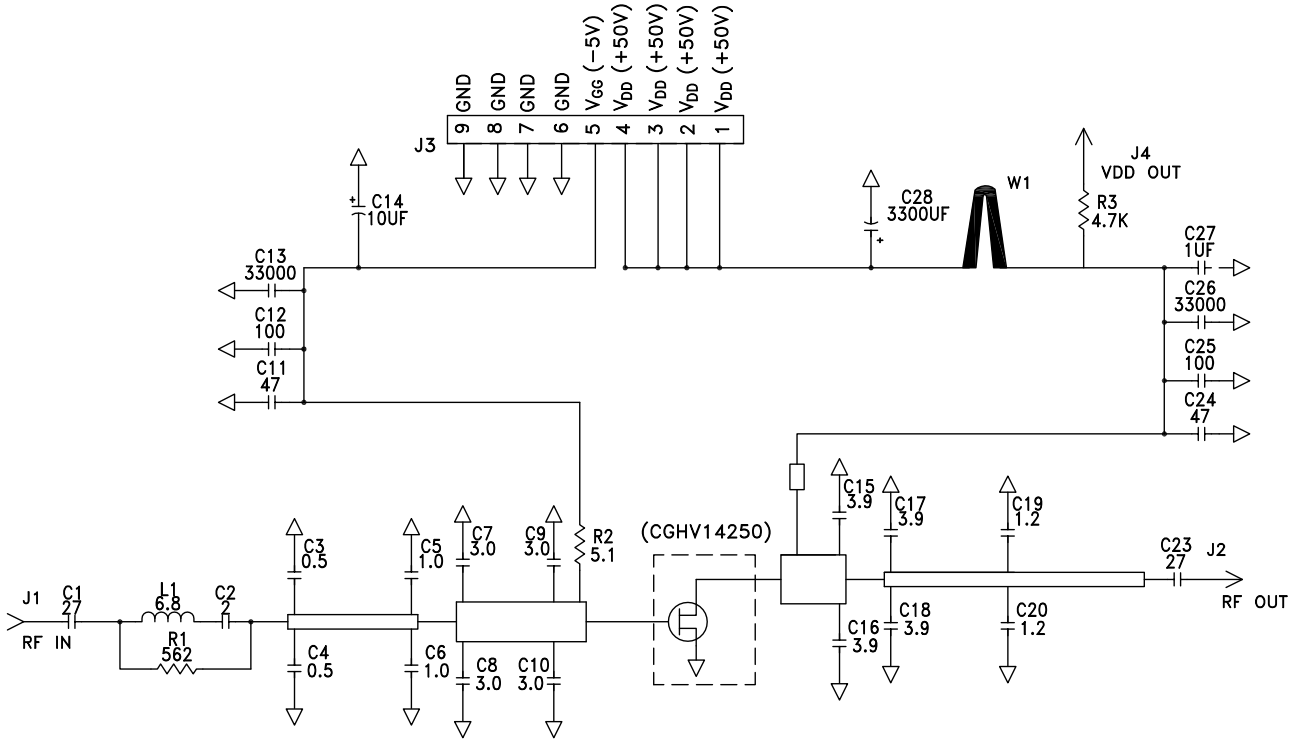
CGHV14250-AMP Demonstration Amplifier Circuit Outline



CGHV14250-AMP Demonstration Amplifier Circuit Schematic



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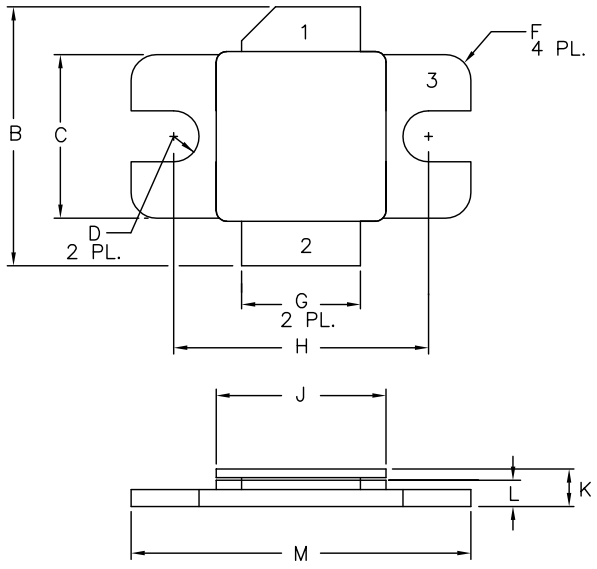
Product Dimensions CGHV14250F (Package Type — 440162)



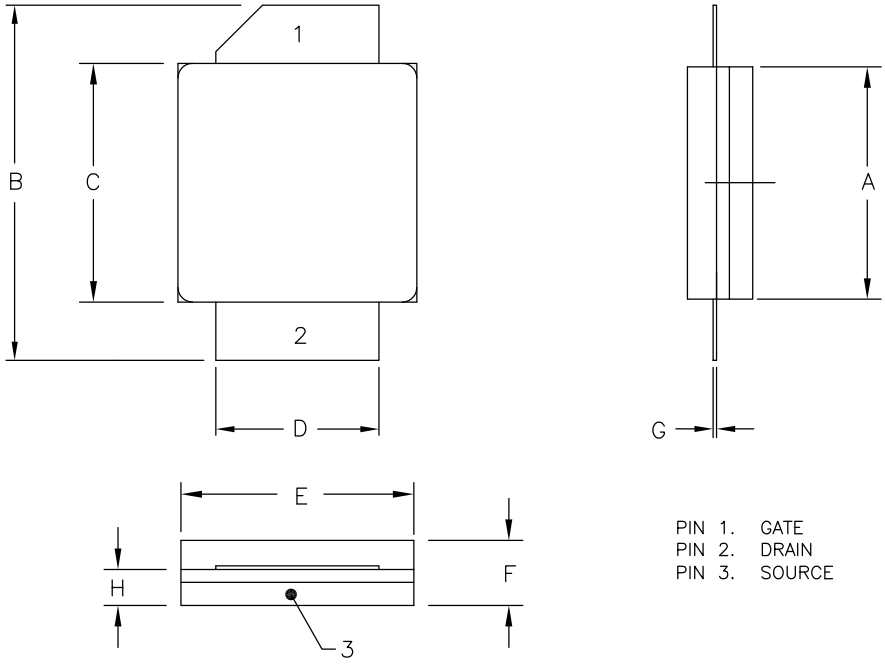
NOTES:

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)



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

NOTES:

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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

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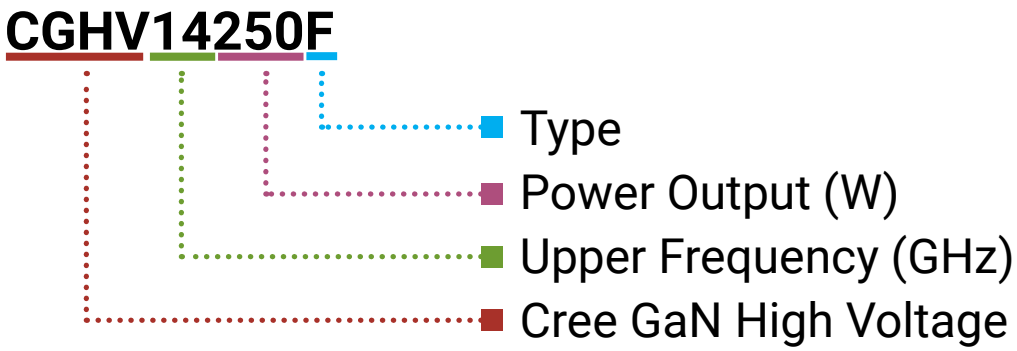
Part Number System



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

Table 1.

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

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

Table 2.

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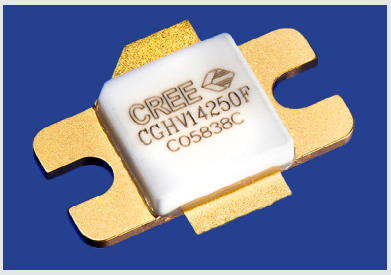
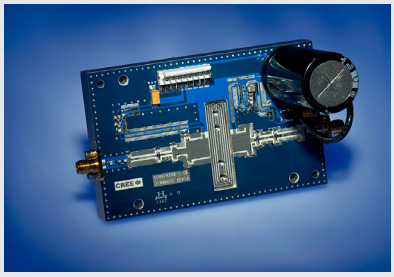
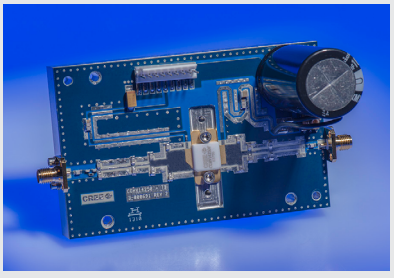
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV14250F	GaN HEMT	Each	
CGHV14250P	GaN HEMT	Each	
CGHV14250-TB	Test board without GaN HEMT	Each	
CGHV14250P-AMP	Test board with GaN HEMT installed	Each	
CGHV14250F-AMP	Test board with GaN HEMT installed	Each	

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