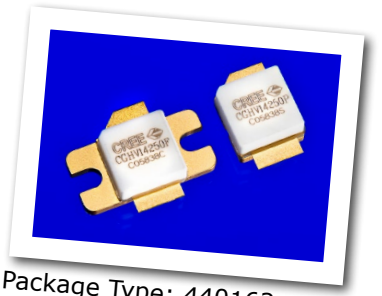
CGHV14250

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 UHF through 1800 MHz. The package options are ceramic/metal flange and pill package.



Package Type: 440162, 440161
PN: CGHV14250

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-TB 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

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

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

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Typical Performance

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

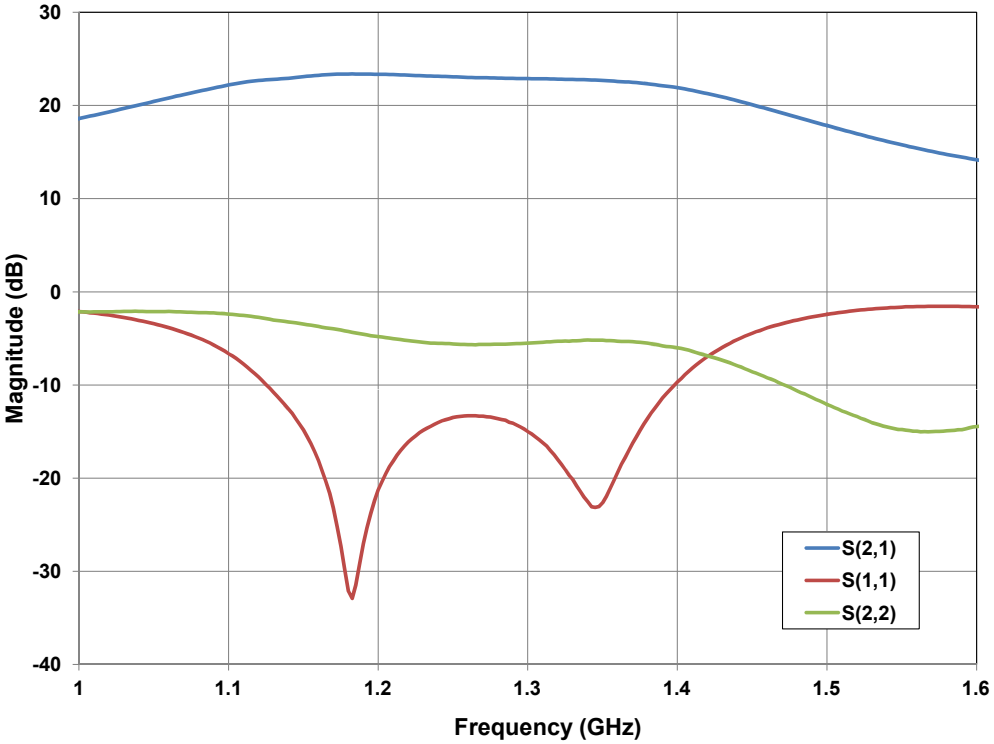
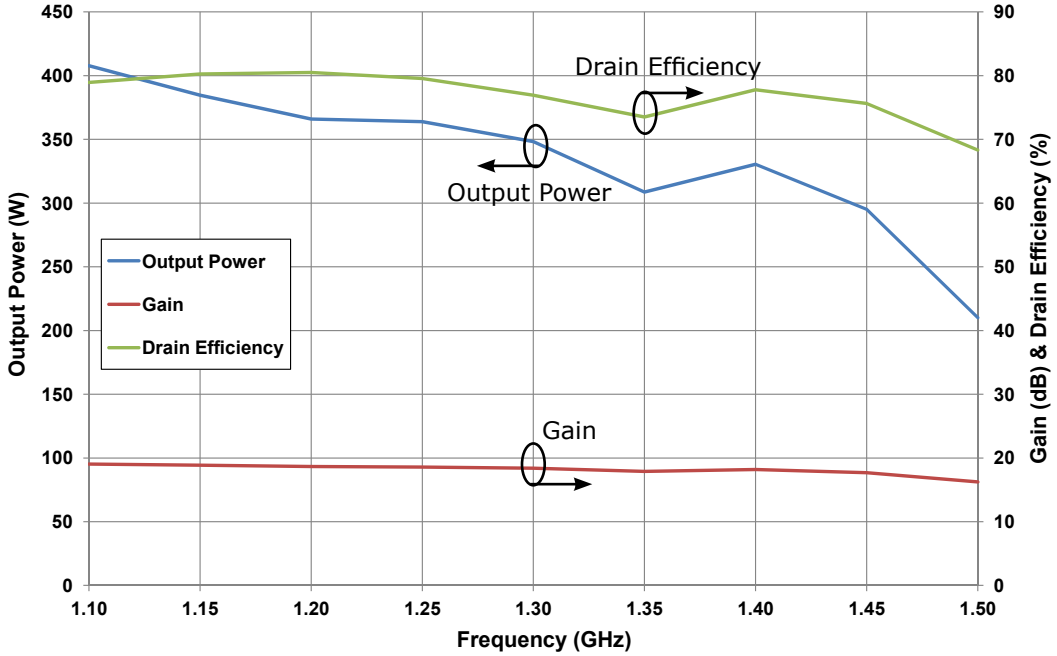


Figure 2. - CGHV14250 Typical RF Results
V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 37 dBm
Tcase = 25°C, Pulse Width = 500 µs, Duty Cycle = 10 %



Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

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 %

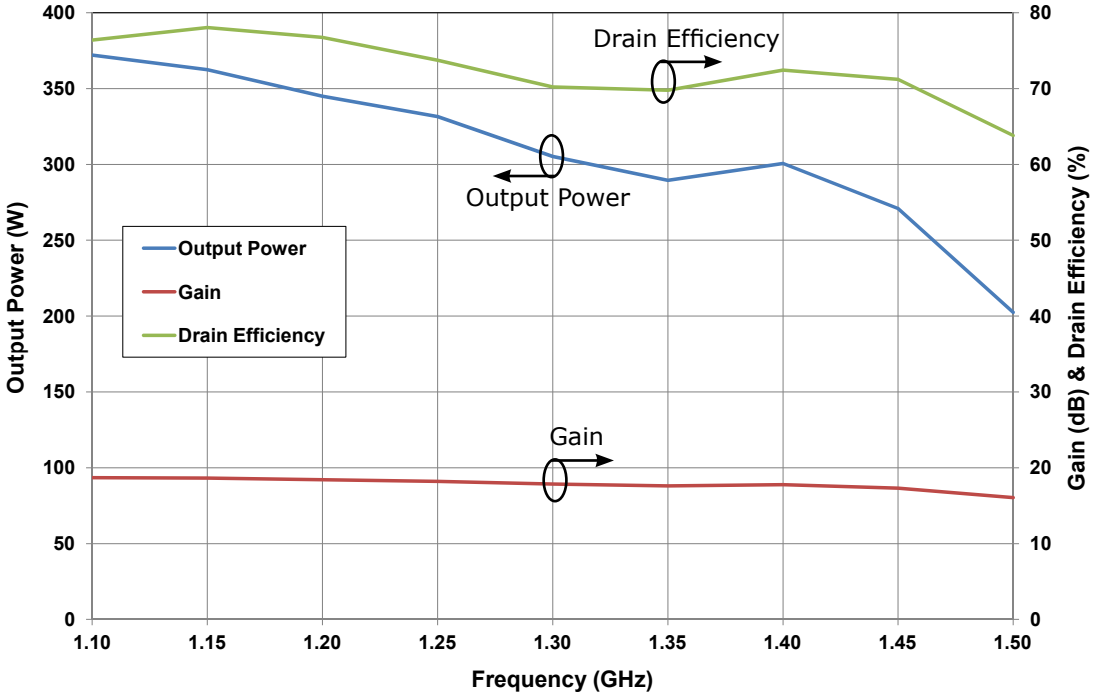
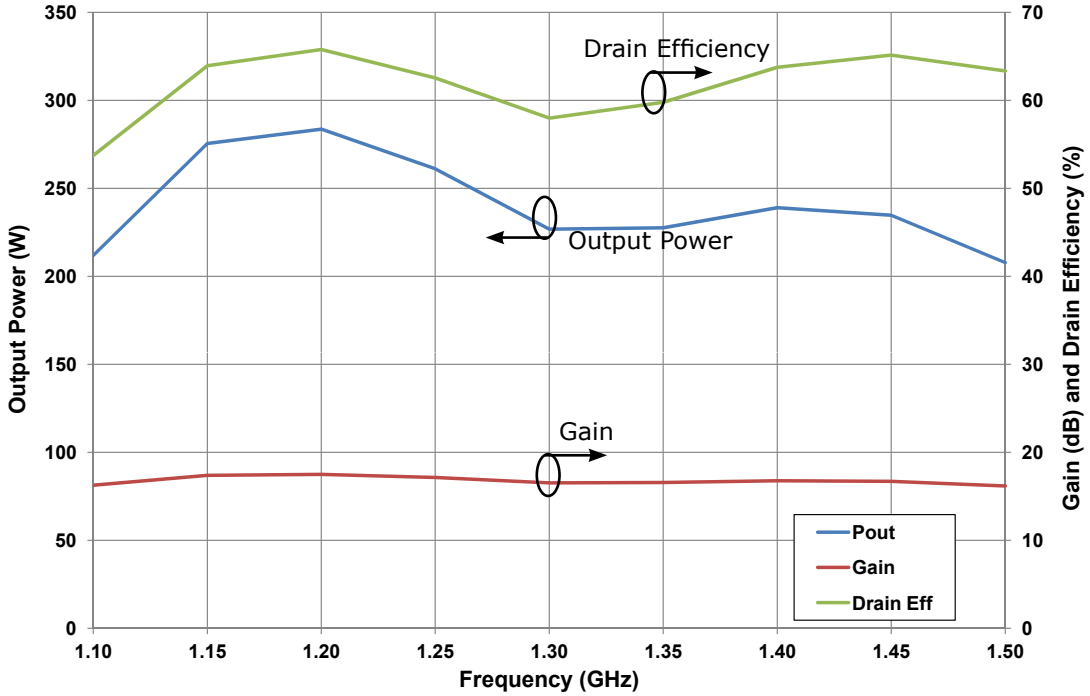
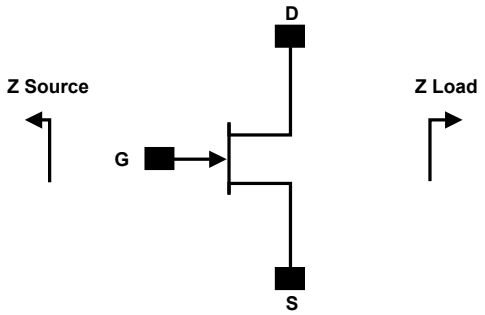


Figure 4. - CGHV14250 CW RF Results
V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 37 dBm, Tcase = 65°C



Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Source and Load Impedances

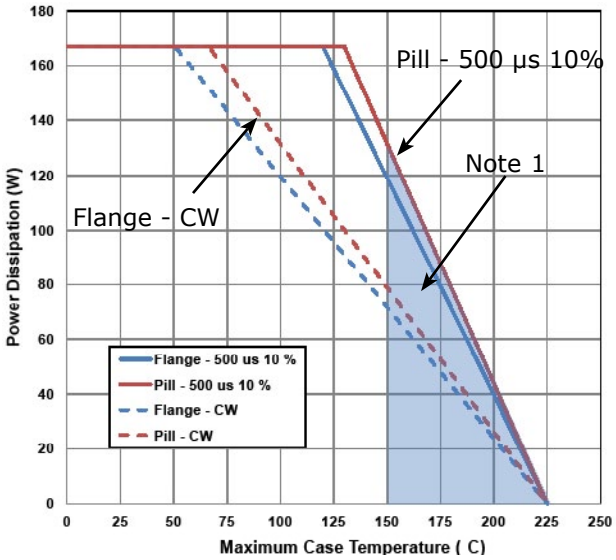


Frequency (MHz)	Z Source	Z Load
900	0.6 - j0.3	5.3 + j0.1
1000	0.7 - j0.8	4.3 +j0.8
1100	1.3 - j1.1	3.3 + j0.8
1200	1.8 - j1.1	3.0 + j0.4
1300	2.5 - j0.7	2.5 + j0.4
1400	3.4 - j0.7	2.3 + j0.1
1500	1.8 - j0.9	2.3 + j0

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



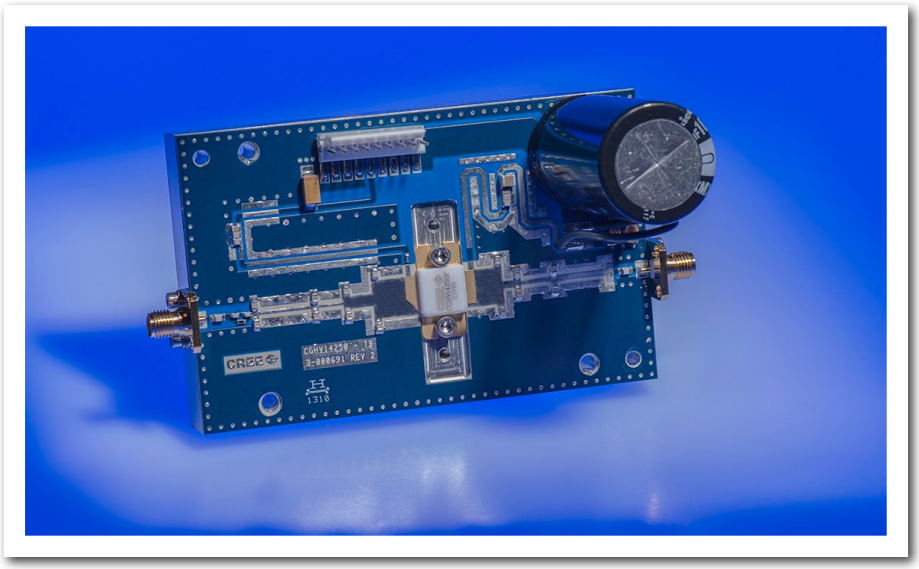
Note 1. Area exceeds Maximum Case Temperature (See Page 2).

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

CGHV14250-TB Demonstration Amplifier Circuit Bill of Materials

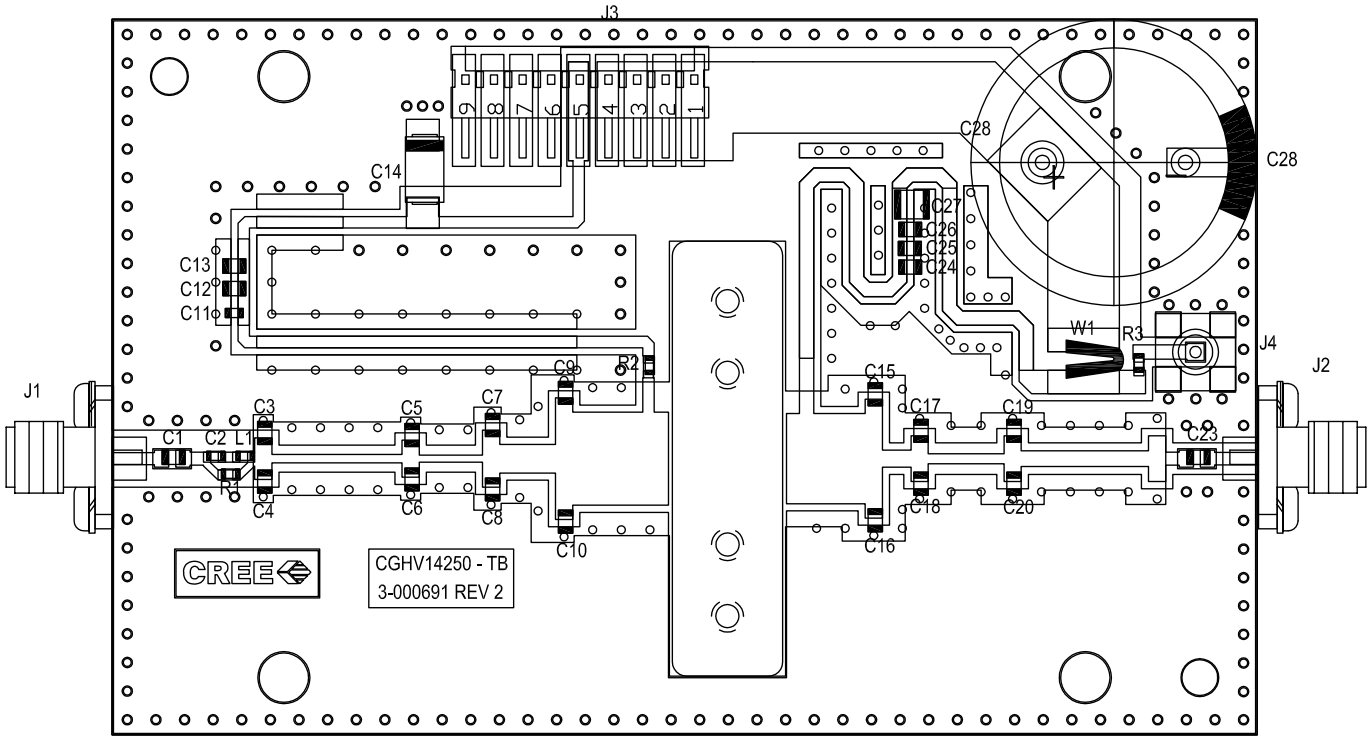
Designator	Description	Qty
R1	RES, 1/16W, 0603, 1%, 562 OHMS	1
R2	RES, 5.1 OHM, +/-1%, 1/16W, 0603	1
R3	RES, 1/16W, 0603, 1%, 4700 OHMS	1
L1	INDUCTOR, CHIP, 6.8 nH, 0603 SMT	1
C1, C23	CAP, 27pF, +/- 5%, 250V, 0805, ATC 600F	2
C2	CAP, 2.0pF, +/- 0.1pF, 0603, ATC	1
C3, C4	CAP, 0.5pF, +/-0.05pF, 0805, ATC 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-TB Demonstration Amplifier Circuit

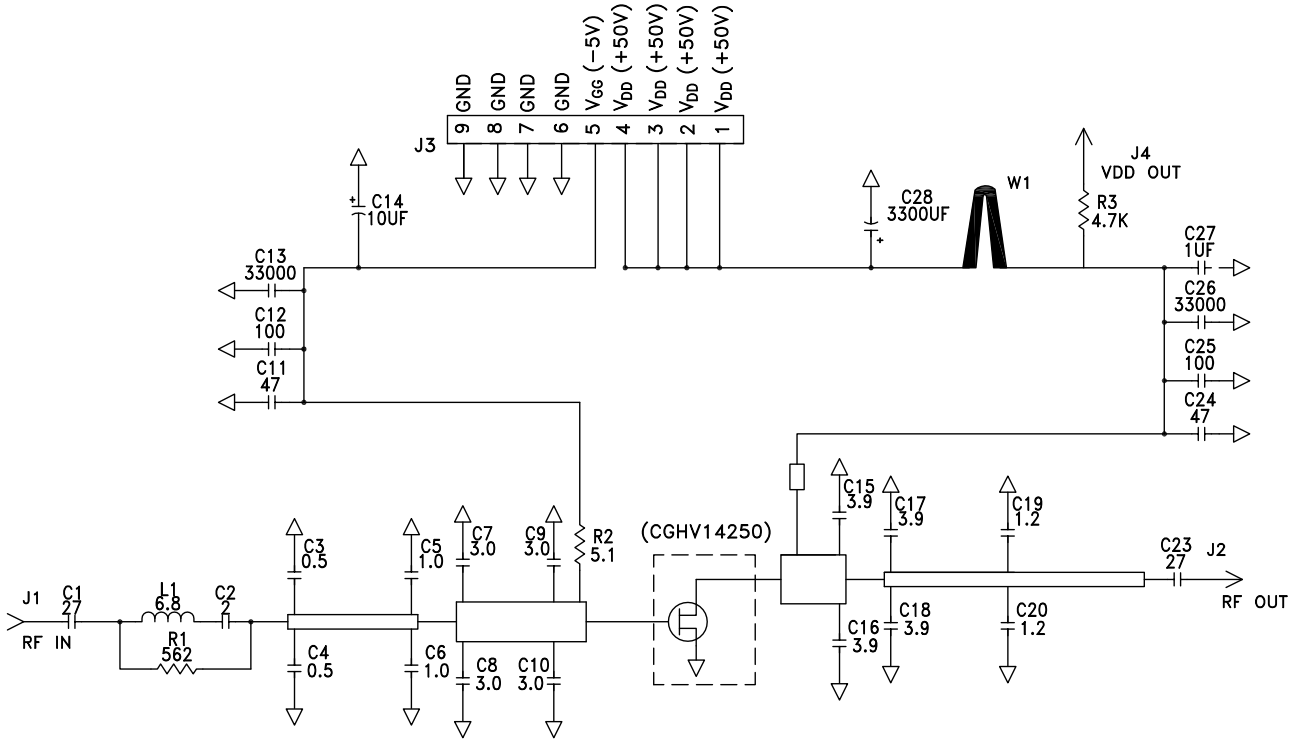


Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

CGHV14250-TB Demonstration Amplifier Circuit Outline

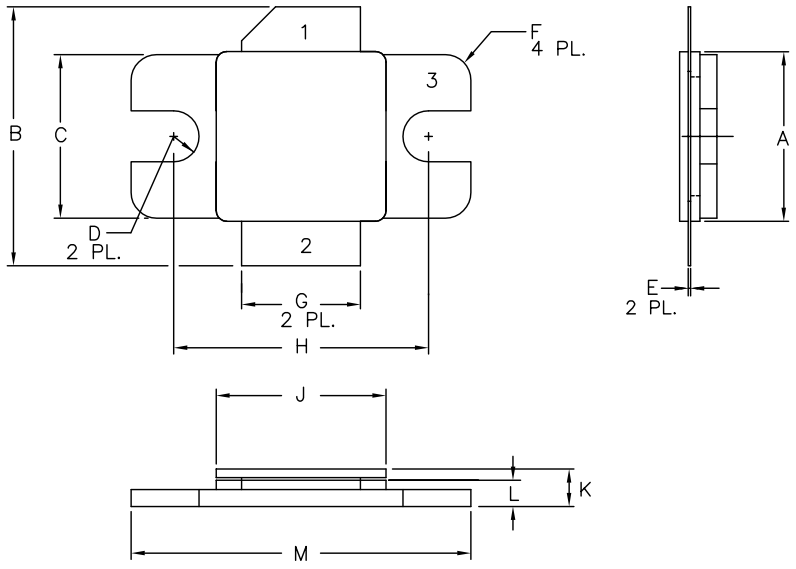


CGHV14250-TB Demonstration Amplifier Circuit Schematic



Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Product Dimensions CGHV14250F (Package Type — 440162)



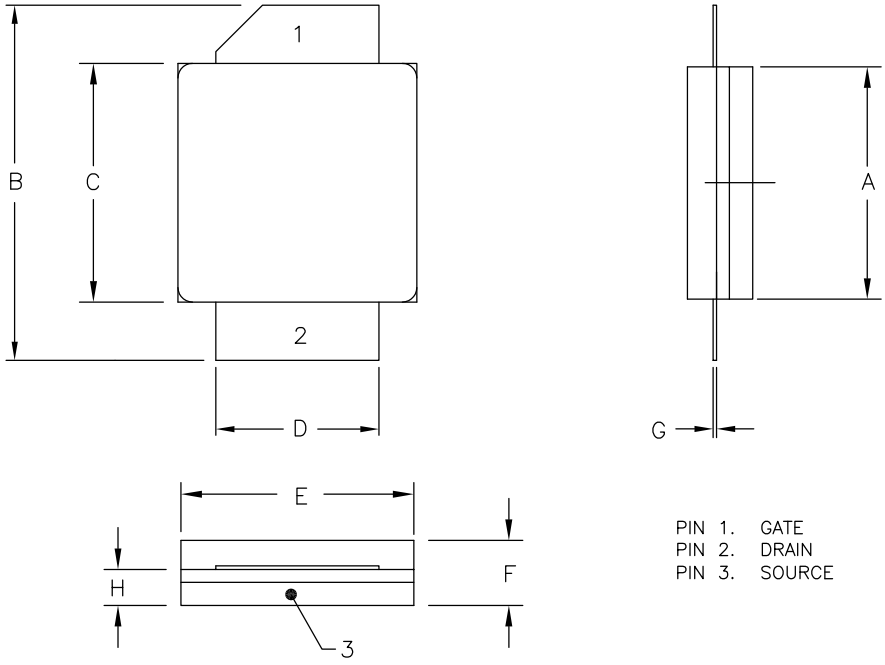
NOTES:

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:

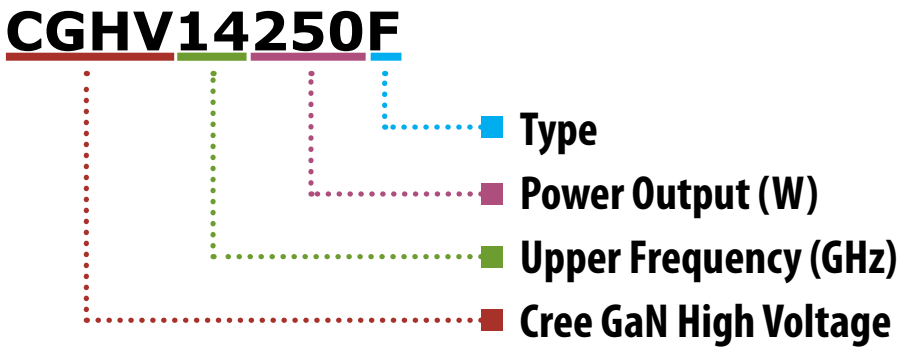
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
4. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

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

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

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.

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Disclaimer

Specifications are subject to change without notice. Cree, Inc. believes the information contained within this data sheet to be accurate and reliable. However, no responsibility is assumed by Cree for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Cree. Cree makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose. "Typical" parameters are the average values expected by Cree in large quantities and are provided for information purposes only. These values can and do vary in different applications and actual performance can vary over time. All operating parameters should be validated by customer's technical experts for each application. Cree products are not designed, intended or authorized for use as components in applications intended for surgical implant into the body or to support or sustain life, in applications in which the failure of the Cree product could result in personal injury or death or in applications for planning, construction, maintenance or direct operation of a nuclear facility.

For more information, please contact:

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
www.cree.com/rf

Sarah Miller
Marketing & Export
Cree, RF Components
1.919.407.5302

Ryan Baker
Marketing
Cree, RF Components
1.919.407.7816

Tom Dekker
Sales Director
Cree, RF Components
1.919.407.5639

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf