CGHV31500F

500 W, 2700 - 3100 MHz, 50-Ohm Input/Output Matched, GaN HEMT for S-Band Radar Systems

Cree's CGHV31500F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV31500F ideal for 2.7 - 3.1 GHz S-Band radar amplifier applications. The transistor is supplied in a ceramic/metal flange package, type 440217.

PN: CGHV31500F
Package Type: 440217

Typical Performance Over 2.7-3.1 GHz (T_c = 25°C) of Demonstration Amplifier

Parameter	2.7 GHz	2.9 GHz	3.1 GHz	Units
Output Power	650	705	605	W
Gain	12.1	12.5	11.8	dB
Drain Efficiency	70	68	58	%

Note:
Measured in the CGHV31500F-AMP application circuit, under 100 μs pulse width, 10% duty cycle, P_{IN} = 46 dBm.

Features

- 2.7 - 3.1 GHz Operation
- 650 W Typical Output Power
- 12 dB Power Gain
- 65% Typical Drain Efficiency
- 50 Ohm Internally Matched
- <0.3 dB Pulsed Amplitude Droop

Absolute Maximum Ratings (not simultaneous)

Parameter	Symbol	Rating	Units	Conditions
Pulse Width	PW	100	µs	
Duty Cycle	DC	10	%	
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}	80	mA	25˚C
Maximum Drain Current[1]	I_{DMAX}	24	A	25˚C
Soldering Temperature[2]	T_S	245	˚C	
Screw Torque	τ	40	in-oz	
Pulsed Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.22	˚C/W	100 µsec, 10%, 85˚C , P_{DISS} = 376 W
Case Operating Temperature	T_C	-40, +125	˚C	

Notes:
[1] Current limit for long term, reliable operation
[2] Refer to the Application Note on soldering at http://www.cree.com/rf/document-library

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 = 83.6 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	V_{DC}	V_{DS} = 50 V, I_D = 0.5 A
Saturated Drain Current[2]	I_{DS}	62.7	75.5	–	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 = 83.6 mA

Notes:
[1] Measured on wafer prior to packaging.
[2] Scaled from PCM data.

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

Electrical Characteristics Continued...

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
RF Characteristics[3] (T_C = 25°C, F_0 = 2.7 - 3.1 GHz unless otherwise noted)						
Output Power at 2.7 GHz	P_{OUT1}	–	650	–	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Output Power at 2.9 GHz	P_{OUT2}	–	705	–	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Output Power at 3.1 GHz	P_{OUT3}	–	605	–	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Gain at 2.7 GHz	G_{P1}	–	12.1	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Gain at 2.9 GHz	G_{P2}	–	12.5	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Gain at 3.1 GHz	G_{P3}	–	11.8	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Drain Efficiency at 2.7 GHz	D_{E1}	–	70	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Drain Efficiency at 2.9 GHz	D_{E2}	–	68	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Drain Efficiency at 3.1 GHz	D_{E3}	–	58	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Small Signal Gain	S21	–	14.5	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Input Return Loss	S11	–	-15	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Output Return Loss	S22	–	-5	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Amplitude Droop	D	–	-0.3	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Output Stress Match	VSWR	–	5:1	–	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm Pulsed

Notes:
[3] Measured in CGHV31500F-AMP. Pulse Width = 100 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. - CGHV31500F S-Parameters
V_{DD} = 50 V, I_{DQ} = 0.5 A

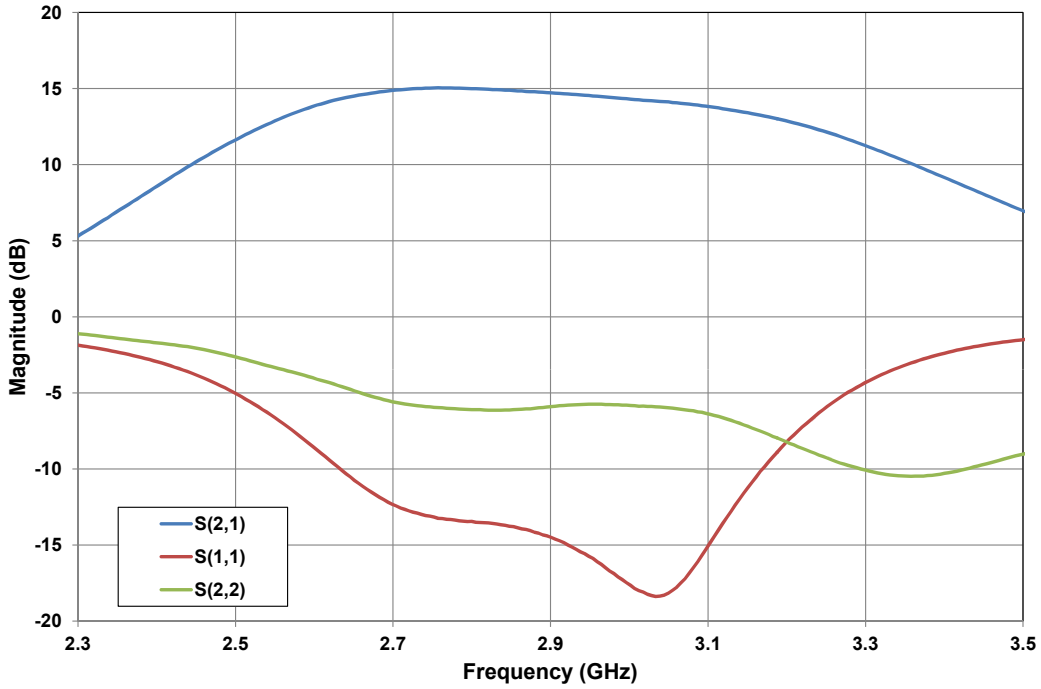
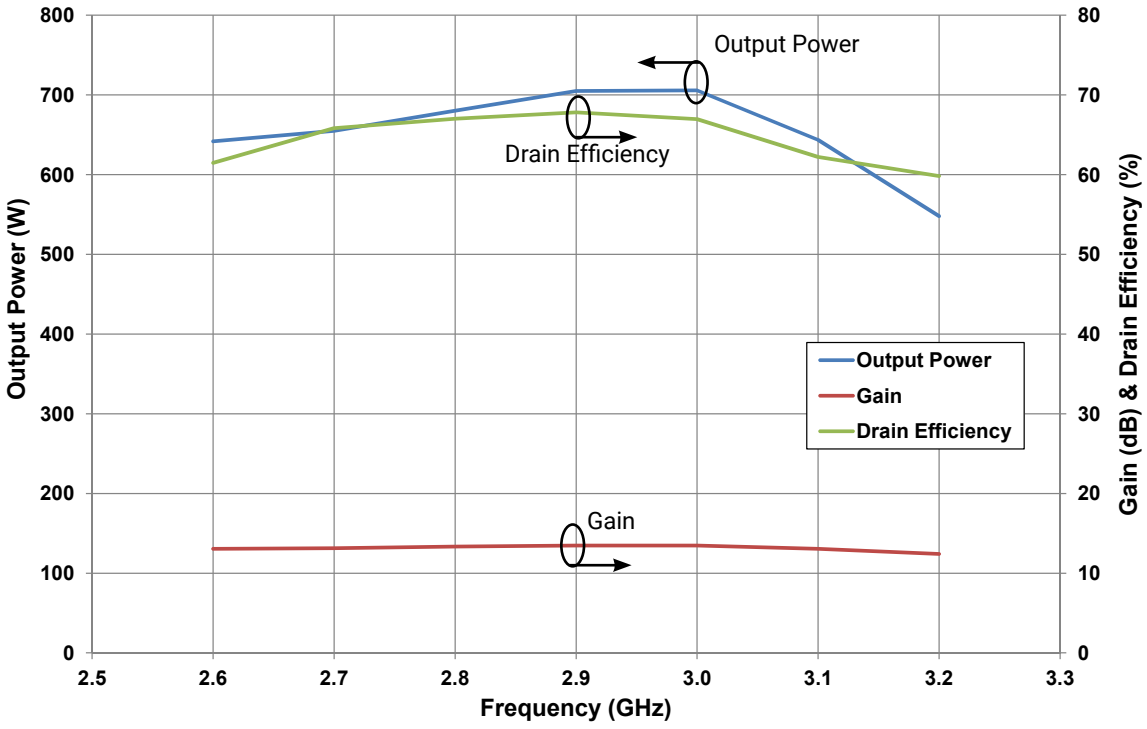


Figure 2. - CGHV31500F Output Power and Drain Efficiency vs Frequency
V_{DD} = 50 V, I_{DQ} = 0.5 A, P_{IN} = 46 dBm, Pulse Width = 100µs, Duty Cycle = 10%, T_{CASE} = 25°C



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

Typical Performance

Figure 3. - CGHV31500F Drain Efficiency & Gain vs. Input Power
V_{DD} = 50 V, I_{DQ} = 500 mA, Pulse Width = 100 us, Duty Cycle = 10 %

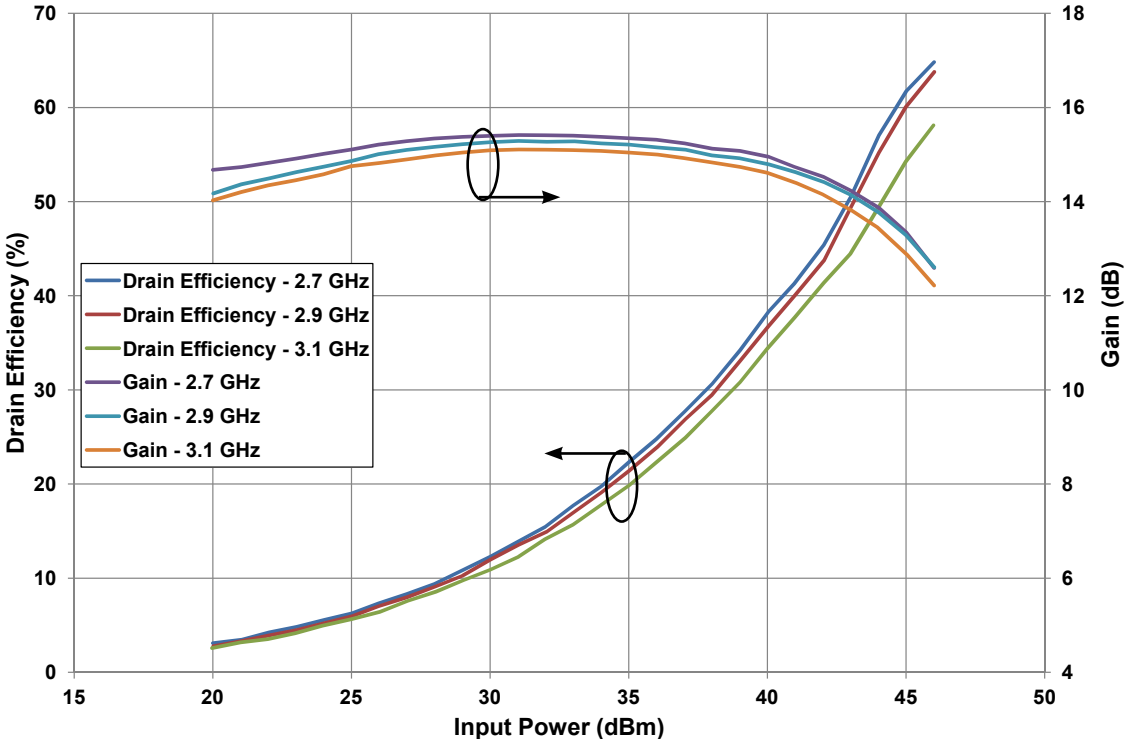
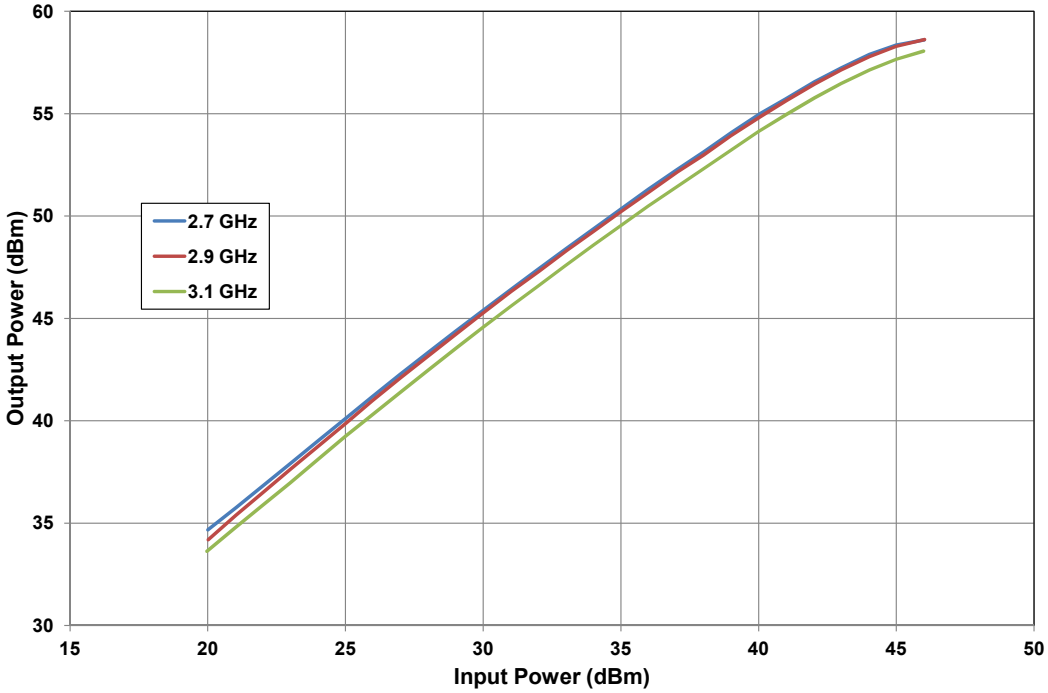


Figure 4. - CGHV31500F Output Power vs. Input Power
V_{DD} = 50 V, I_{DQ} = 0.5 A, Pulse Width = 100µs, Duty Cycle = 10%, T_{CASE} = 25°C

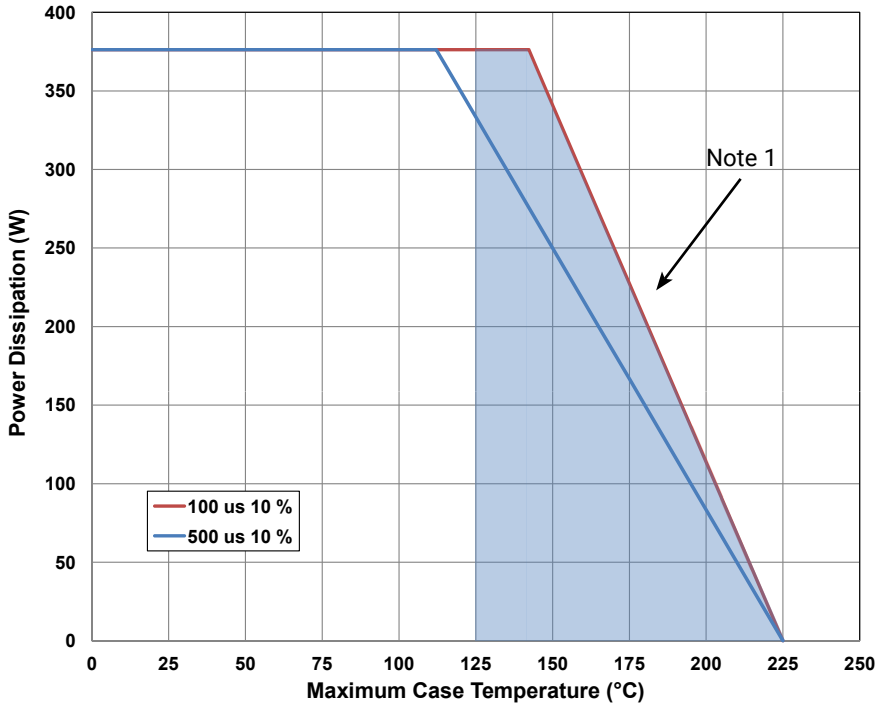


Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

CGHV31500F-AMP Application Circuit Bill of Materials

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, RO4350, 2.5 X 4.0 X 0.030	1
Q1	CGHV31500F	1

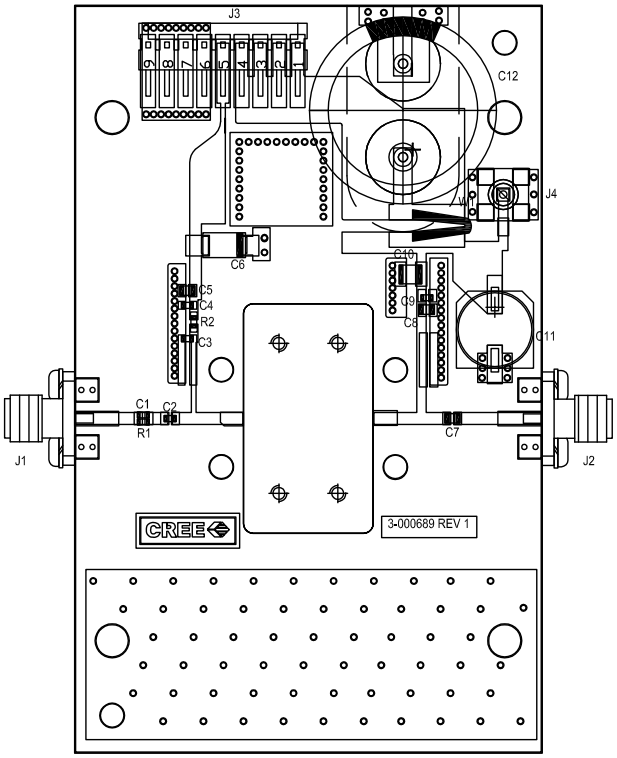
CGHV31500F Power Dissipation De-rating Curve



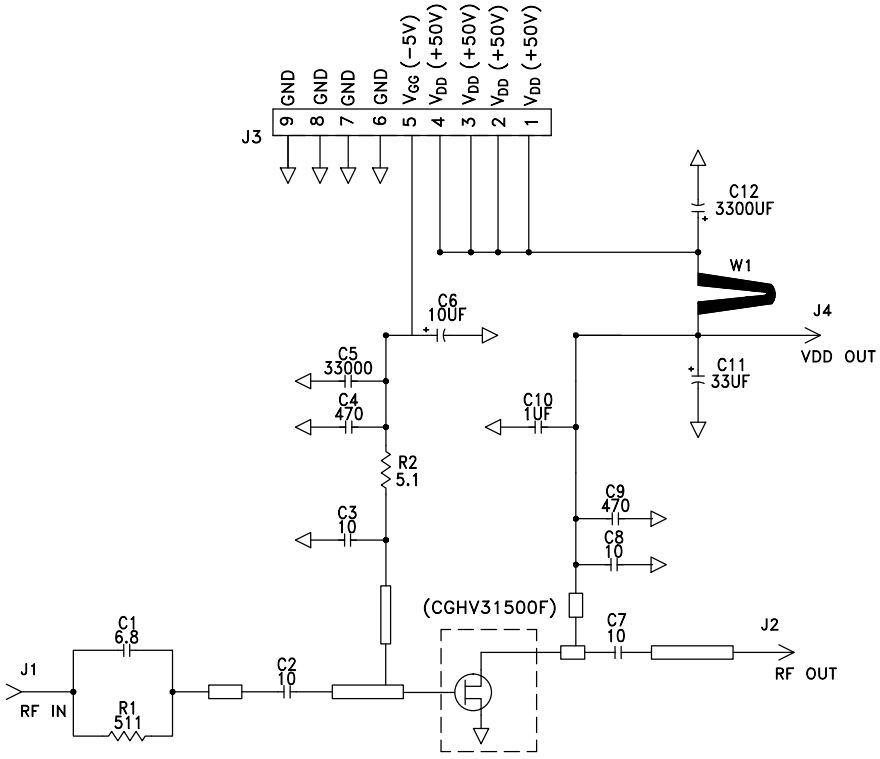
Note 1. Area exceeds Maximum Case Temperature (See Page 2).

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

CGHV31500F-AMP Application Circuit Outline



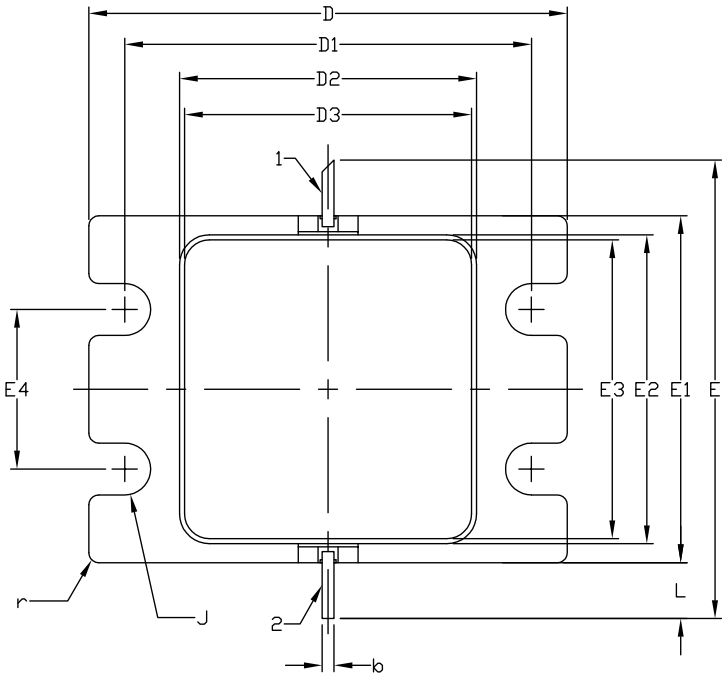
CGHV31500F-AMP Application Circuit Schematic

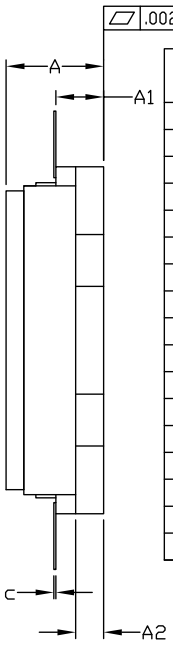


Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Product Dimensions CGHV31500F (Package Type — 440217)

4. ALL PLATED SURFACES ARE GOLD OVER NICKEL



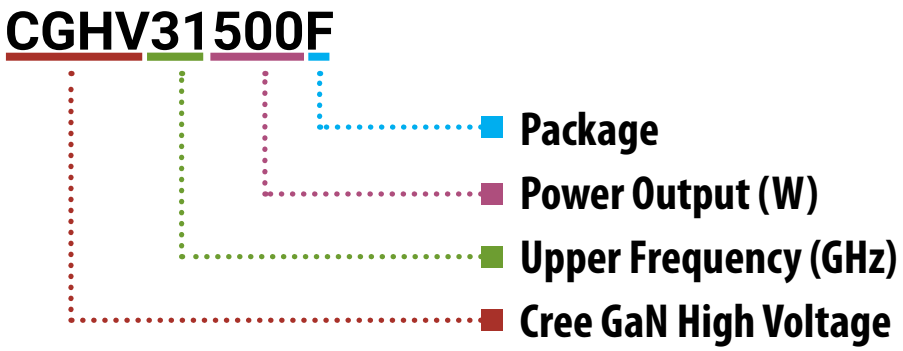


1. GATE
2. DRAIN

DIM	INCHES		MILLIMETERS		NOTE
	MIN	MAX	MIN	MAX	
A	0.188	0.198	4.78	5.03	
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	0.002	0.006	0.05	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	0.563	0.571	14.30	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	0.586	0.594	14.88	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		12

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]	3.1	GHz
Power Output	500	W
Package	Flange	-

Table 1.

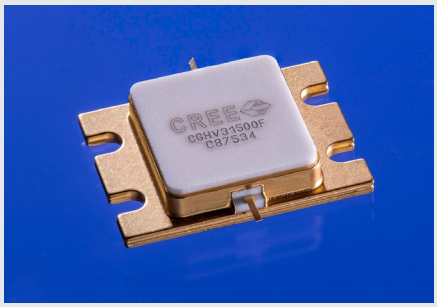
Note[1]: Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

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

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV31500F	GaN HEMT	Each	
CGHV31500F-TB	Test board without GaN HEMT	Each	
CGHV31500F-AMP	Test board with GaN HEMT installed	Each	

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
Cree, RF Components
1.919.407.5302

Ryan Baker
Marketing & Sales
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