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

Rev 3.0 - July 2018

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.

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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}	473	630	–	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Output Power at 2.9 GHz	P_{OUT2}	555	725	–	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Output Power at 3.1 GHz	P_{OUT3}	473	630	–	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}	57	68	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Drain Efficiency at 2.9 GHz	D_{E2}	54	67	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Drain Efficiency at 3.1 GHz	D_{E3}	50	62	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 46 dBm
Small Signal Gain	S21	11.25	14.5	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 10 dBm
Input Return Loss	S11	–	-15	-5.25	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 10 dBm
Output Return Loss	S22	–	-5	-3	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 10 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%.

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Typical Performance

Figure 1. - CGHV31500F S-Parameters
V_{DD} = 50 V, I_{DQ} = 0.5 A

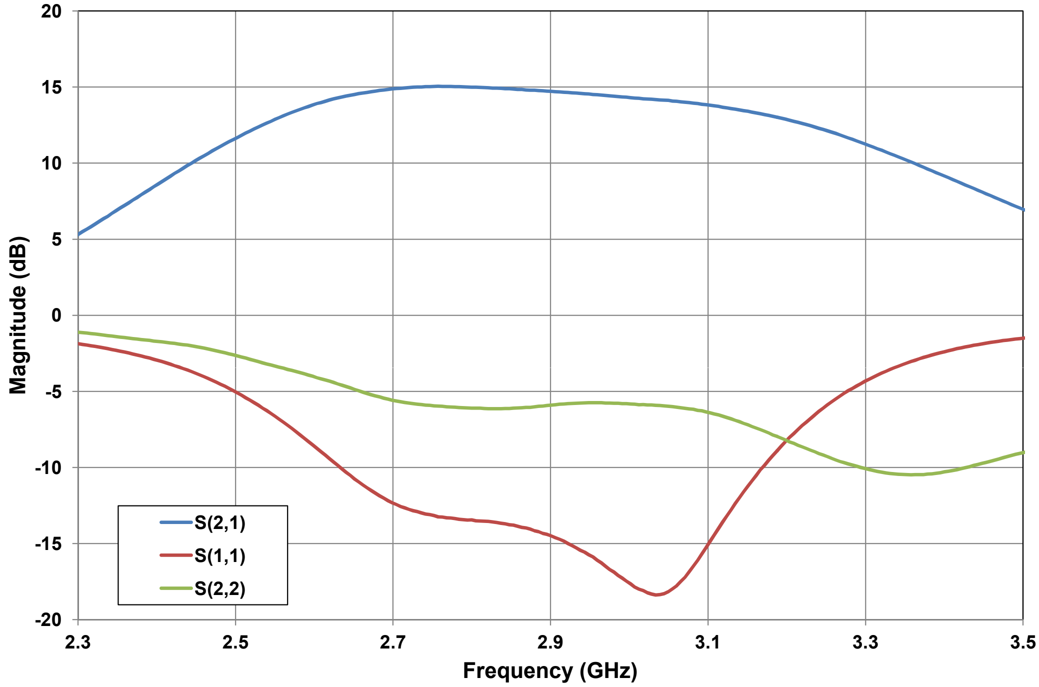
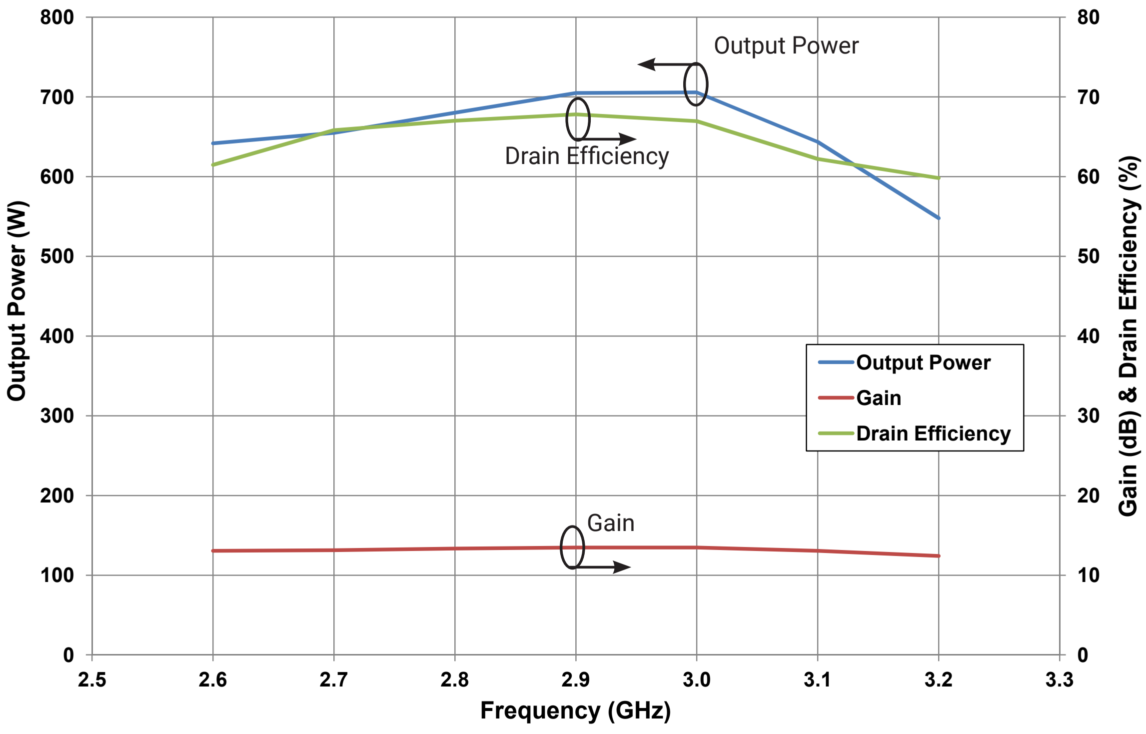


Figure 2. - CGHV31500F Output Power and Drain Efficiency vs Frequency
V_{DD} = 50 V, I_{DQ} = 0.5 A, P_{IN} = 46 dBm, Pulse Width = 100µs, Duty Cycle = 10%, T_{CASE} = 25°C



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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 %

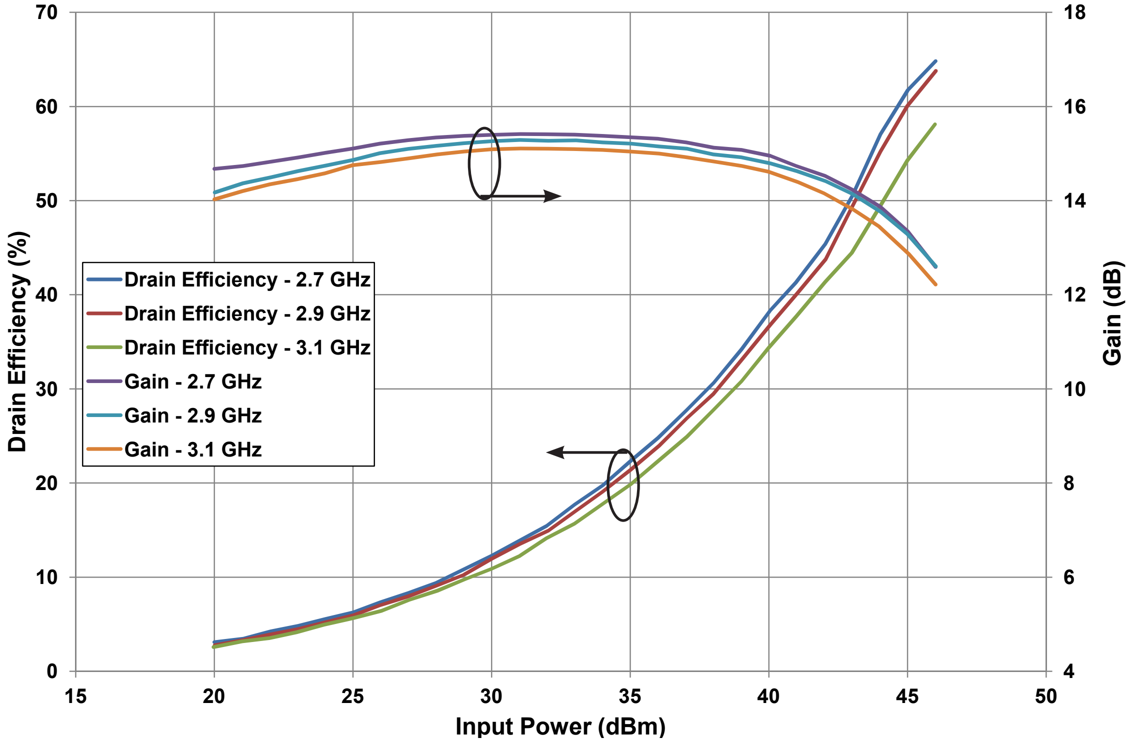
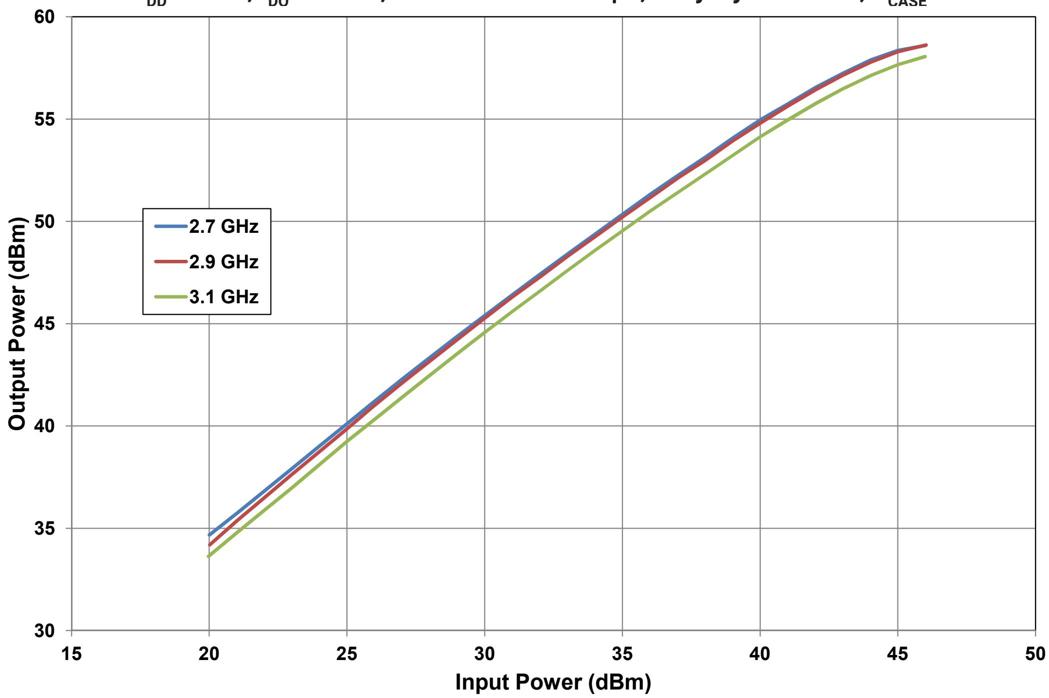


Figure 4. - CGHV31500F Output Power vs. Input Power
V_{DD} = 50 V, I_{DO} = 0.5 A, Pulse Width = 100µs, Duty Cycle = 10%, T_{CASE} = 25°C



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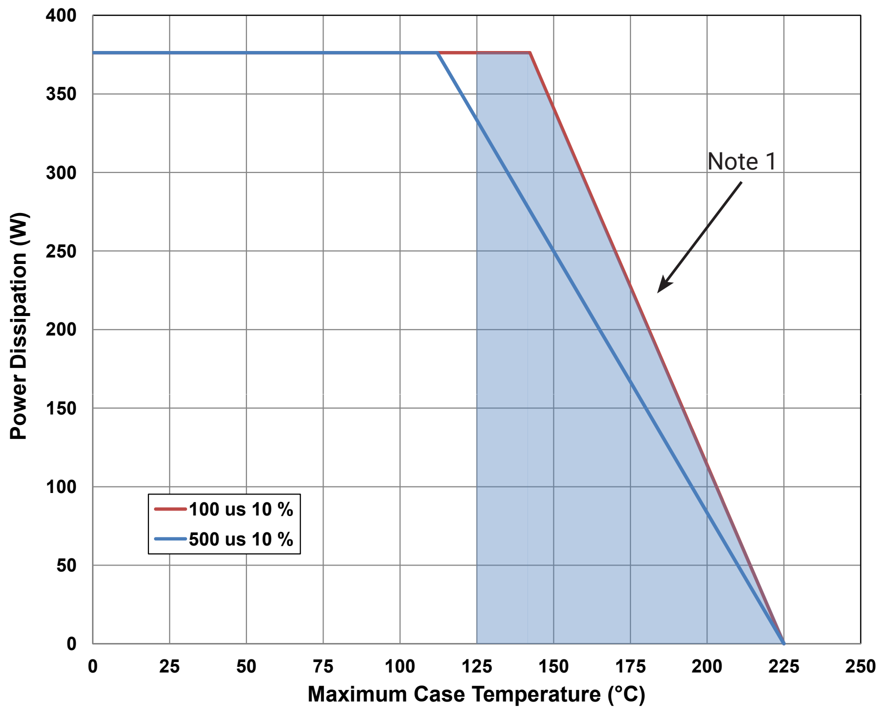
CGHV31500F-AMP Application Circuit Bill of Materials

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).

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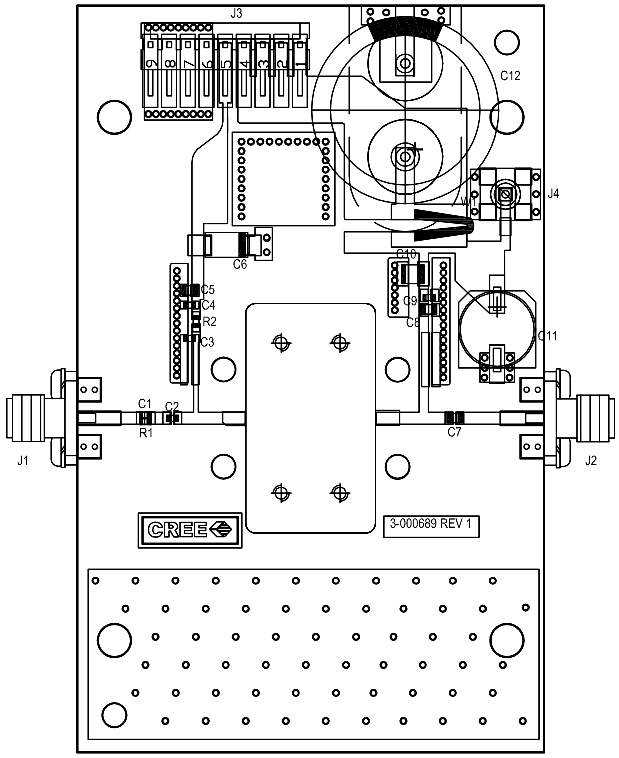
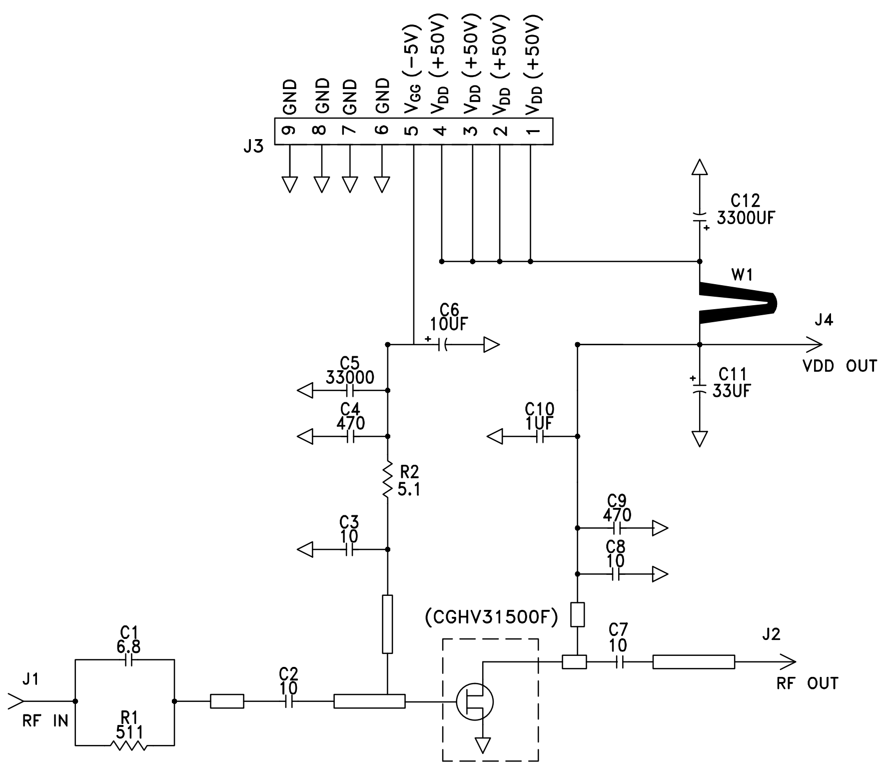
CGHV31500F-AMP Application Circuit Outline



CGHV31500F-AMP Application Circuit Schematic



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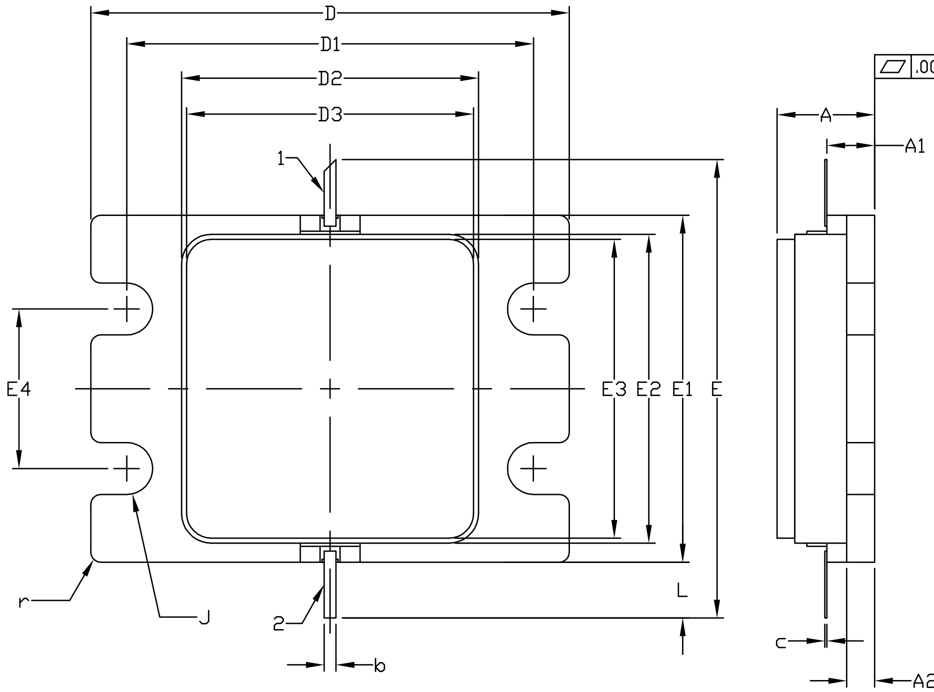
Product Dimensions CGHV31500F (Package Type — 440217)

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

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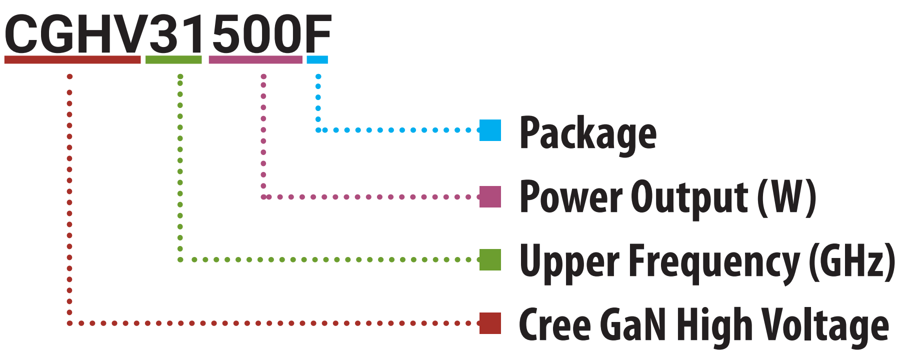
Part Number System



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.

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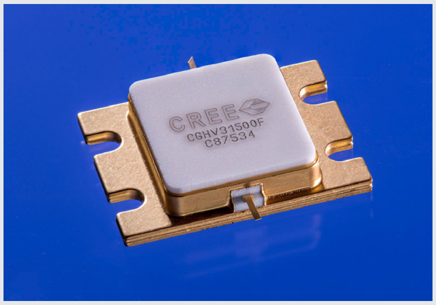
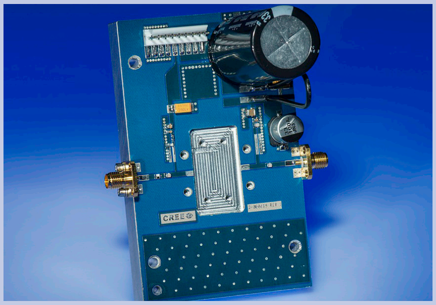
Product Ordering Information

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	

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