CGHV14800F

800 W, 1200 - 1400 MHz, 50 V, GaN HEMT for L-Band Radar Systems

Cree's CGHV14800 is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV14800 ideal for 1.2 - 1.4 GHz pulsed L-Band radar amplifier applications, such as air traffic control (ATC) radar, weather radar, penetration radars, antimissile system radars, target tracking radars and long range surveillance radars. The GaN HEMT typically operates at 50 V, typically delivering >65% drain efficiency. The package options are ceramic/metal flange package.

Package Type: 440117
PN: CGHV14800F

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	1000	940	940	920	910	W
Power Gain	15.5	15.2	15.2	15.1	15.1	dB
Drain Efficiency	74	73	73	69	67	%

Note:
Measured in the CGHV14800-AMP amplifier circuit, under 100 µs pulse width, 5% duty cycle, P_{IN} = 44.5 dBm.

Features

- Reference design amplifier 1.2 - 1.4 GHz Operation
- 910 W Typical Output Power
- 14 dB Power Gain
- 70% Typical Drain Efficiency
- <0.3 dB Pulsed Amplitude Droop
- Internally input and output matched

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}	132	mA	25˚C
Maximum DC Current[1]	I_{DCMAX}	24	A	25˚C
Maximum Duty Cycle	D	5	%	
Soldering Temperature[2]	T_S	245	˚C	
Screw Torque	τ	40	in-oz	
CW Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	0.47	˚C/W	P_{DISS} = 398 W, 45˚C
Pulsed Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	0.16	˚C/W	P_{DISS} = 664 W, 100 µsec, 5%, 85˚C
Case Operating Temperature[4]	T_C	-40, +100	˚C	P_{DISS} = 664 W, 100 µsec, 5%

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 CGHV14800F

[4] See also, the Power Dissipation De-rating Curve on Page 6

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 = 800 mA
Saturated Drain Current[2]	I_{DS}	80.3	123.5	–	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
RF Characteristics[3] (T_C = 25˚C, F_0 = 1.3 GHz unless otherwise noted)						
Output Power	P_{OUT}	804	977	–	W	V_{DD} = 50 V, I_{DQ} = 800 mA, F = 1.2 GHz, P_{IN} = 44.5 dBm
Drain Efficiency	D_E	62	71	–	%	V_{DD} = 50 V, I_{DQ} = 800 mA, F = 1.2 GHz, P_{IN} = 44.5 dBm
Output Power	P_{OUT}	795	933	–	W	V_{DD} = 50 V, I_{DQ} = 800 mA, F = 1.23 GHz, P_{IN} = 44.5 dBm
Drain Efficiency	D_E	63	71	–	%	V_{DD} = 50 V, I_{DQ} = 800 mA, F = 1.23 GHz, P_{IN} = 44.5 dBm
Output Power	P_{OUT}	750	912	–	W	V_{DD} = 50 V, I_{DQ} = 800 mA, F = 1.4 GHz, P_{IN} = 44.5 dBm
Drain Efficiency	D_E	57	67	–	%	V_{DD} = 50 V, I_{DQ} = 800 mA, F = 1.4 GHz, P_{IN} = 44.5 dBm
Pulsed Amplitude Droop	D	–	-0.3	–	dB	V_{DD} = 50 V, I_{DQ} = 800 mA
Output Mismatch Stress	VSWR	–	9 : 1	–	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 800 mA, P_{IN} = 44.5 dBm Pulsed
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	326	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	643	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	3.9	–	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 CGHV14800-AMP. Pulse Width = 100 µS, Duty Cycle = 5%.

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Typical Pulsed Performance

Figure 1. - Saturated Output Power and Drain Efficiency vs Frequency of the CGHV14800F in the CGHV14800F-AMP
V_{DD} = 50 V, I_{DQ} = 800 mA, Pulse Width = 100 µS, Duty Cycle = 5%

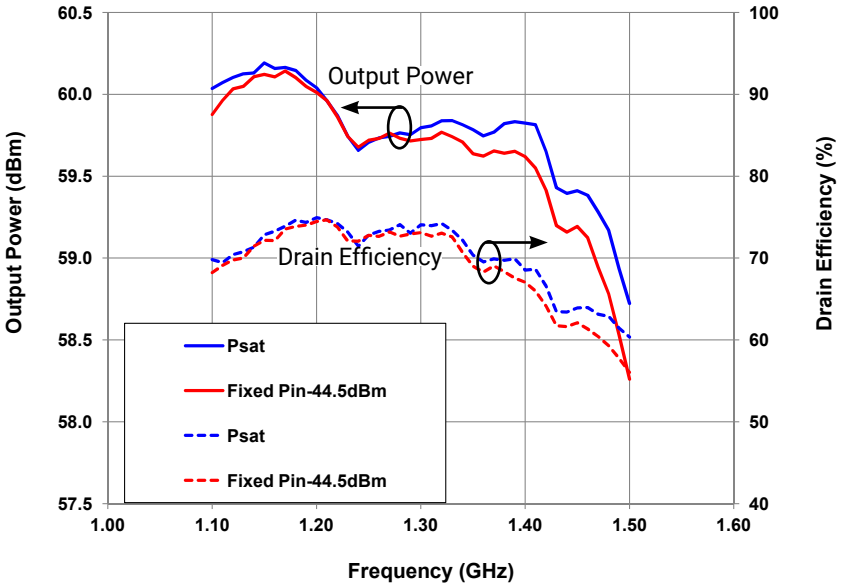
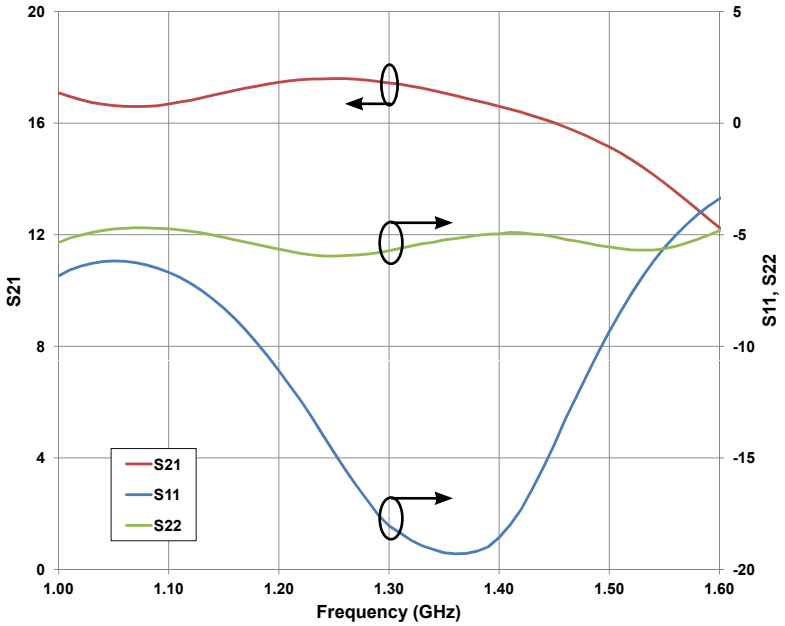


Figure 2. - Small Signal Gain and Return Losses vs Frequency of the CGHV14800F in the CGHV14800F-AMP
V_{DD} = 50 V, I_{DQ} = 800 mA



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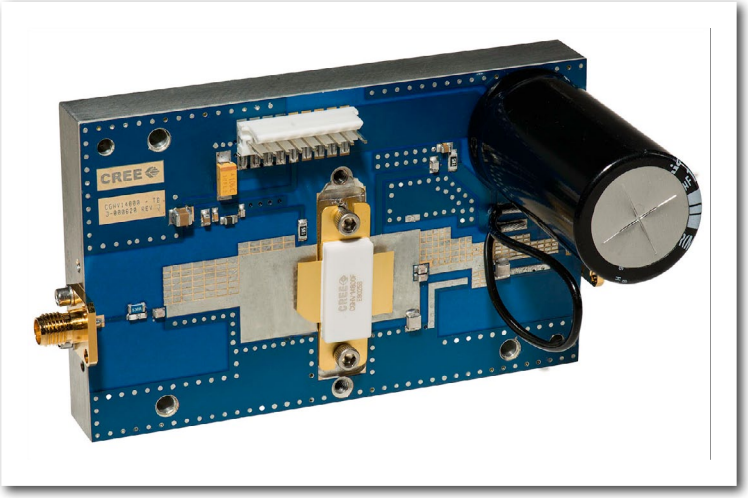
CGHV14800F-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 5.1,OHM, +/- 1%, 0.25W, 1206	1
R2	RES,1/16W,0603,1%,4.99K OHMS	1
R3	RES 536OHM +/- 1%, 0.25W,1206	1
C1	CAP, 100 PF +/-5%, 250V, 0805, ATC 600F	1
C16	CAP, 2.0pF, +/-0.1pF, 0603, ATC	3
C2	CAP, 33pF, +/-5%, 0603, ATC	1
C3	CAP, 470PF, 5%, 100V, 0603, X7R	1
C4, C9	CAP,33000PF, 0805,100V, X7R	2
C5	CAP, 1.0UF, 100V, 10%, X7R, 1210	
C6	CAP 10UF 16V TANTALUM	
C12	CAP, 2.0pF +/-0.1pF, ATC800B	
C13	CAP, 3.0pF +/-0.1 pF, ATC800B	
C7	CAP, 33 PF +/- 5%,, 250V, 0805, ATC 600F	
C11	CAP, 3300 UF, +/-20%, 100V, ELECTROLYTIC	2
C14, C15	CAP, 3.9 pF +/-0.1pF, 0805, ATC	2
J1, J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST	1
J3	HEADER RT>PLZ .1CEN LK 9POS	1
J4	CONNECTOR ; SMB, Straight, JACK,SMD	1
W1	CABLE ,18 AWG, 4.2	1
L1	INDUCTOR, CHIP, 6.8nH, 0603 SMT	2
L2	FERRITE, 220 Ohm, 0805	1
	PCB, TMM10i, 0.025" THK, CGHV14800 1.2-1.4GHZ	1
	2-56 SOC HD SCREW 1/4 SS	1
	#2 SPLIT LOCKWASHER SS	1
Q1	CGHV14800F	1

CGHV14800F-AMP Demonstration Amplifier Circuit



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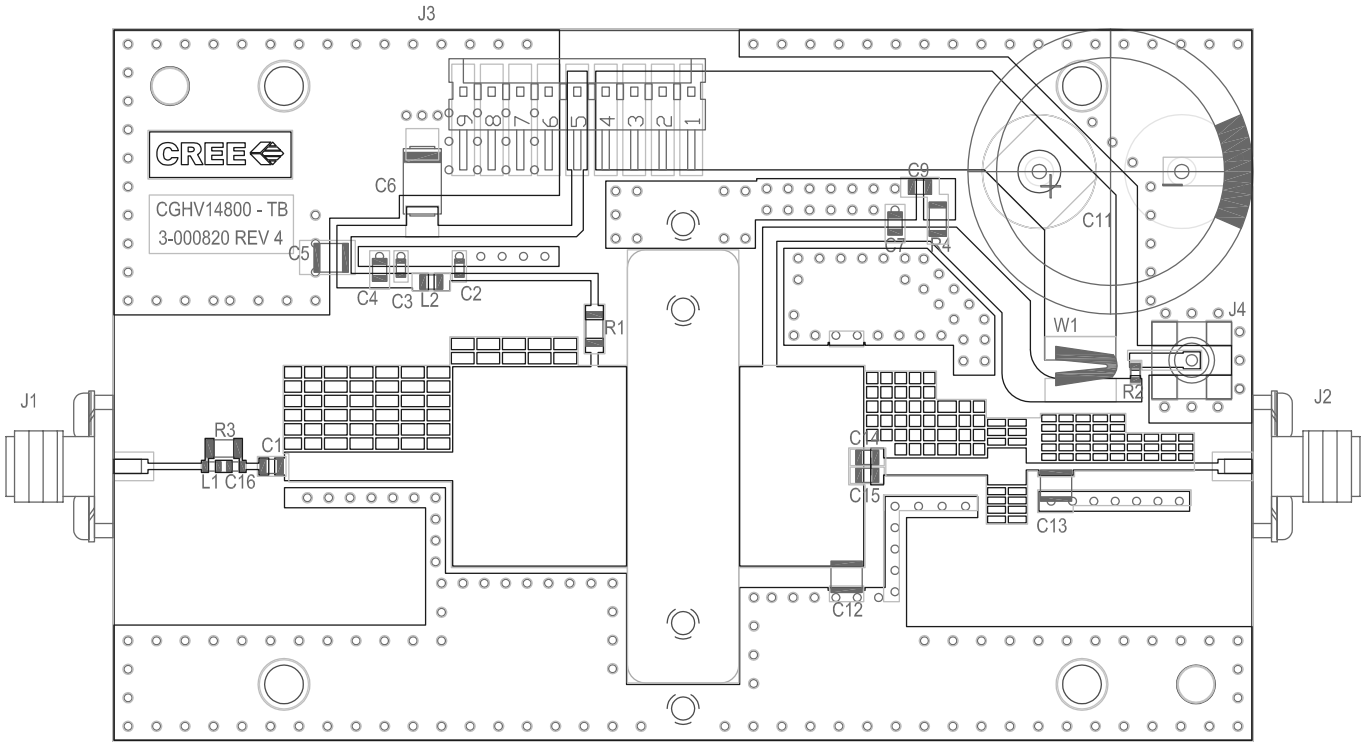
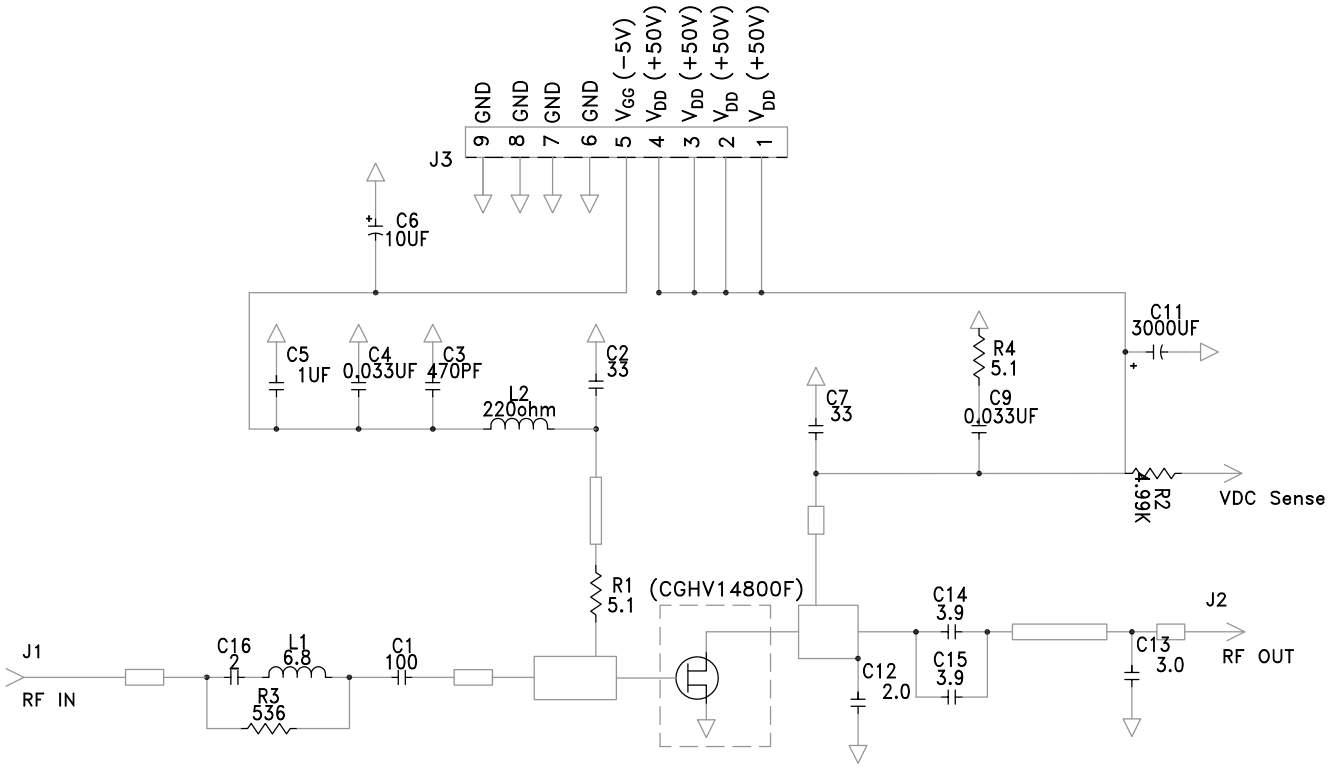
CGHV14800-AMP Demonstration Amplifier Circuit Outline



CGHV14800-AMP Demonstration Amplifier Circuit Schematic



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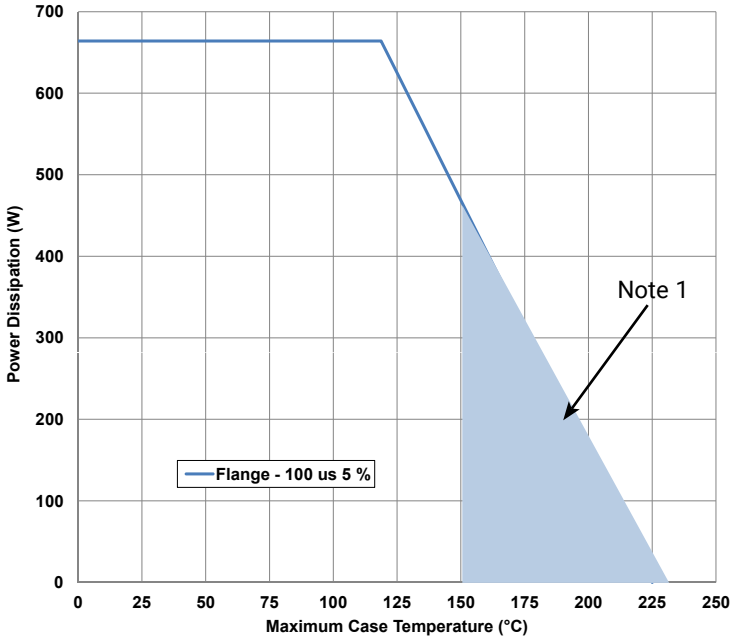
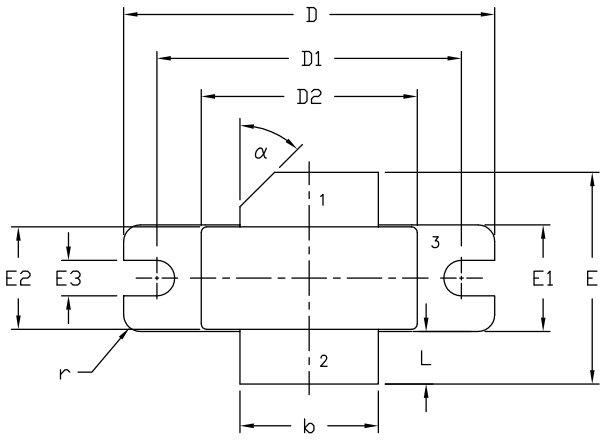
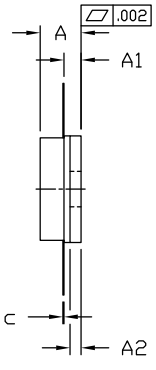
CGHV14800F Power Dissipation De-rating Curve



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

Product Dimensions CGHV14800F (Package Type — 440117)





PIN 1. GATE
2. DRAIN
3. SOURCE

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M – 1994.

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.

	INCHES		MILLIMETERS		NOTES
DIM	MIN	MAX	MIN	MAX	
A	0.138	0.158	3.51	4.01	
A1	0.057	0.067	1.45	1.70	
A2	0.035	0.045	0.89	1.14	
b	0.495	0.505	12.57	12.83	2x
c	0.003	0.006	0.08	0.15	
D	1.335	1.345	33.91	34.16	
D1	1.095	1.105	27.81	28.07	
D2	0.773	0.787	19.63	20.00	
E	0.745	0.785	18.92	19.94	
E1	0.380	0.390	9.65	9.91	
E2	0.365	0.375	9.72	9.53	
E3	0.123	0.133	3.12	3.38	
L	0.170	0.210	4.32	5.33	2x
r	0.06 TYP		0.06 TYP		4x
α	45° REF		45° REF		

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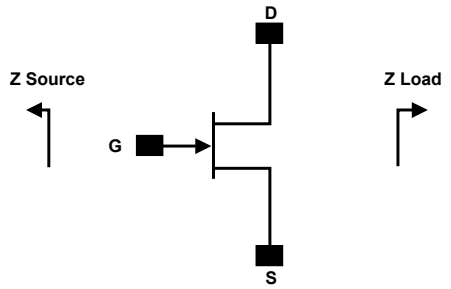
Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
1000	0.51 - j1.44	1.44 - j0.76
1100	0.92 - j1.62	1.30 - j1.55
1200	1.42 - j1.60	1.17 - j1.69
1300	1.79 - j1.04	1.16 - j1.85
1400	1.44 - j0.46	1.08 - j1.99
1500	0.87 - j0.42	1.07 - j2.13
1600	0.52 - j0.66	1.00 - j2.36

Note 1. V_{DD} = 50 V, I_{DQ} = 8 00 mA in the 440117 package
Note 2. Optimized for power gain, P_{SAT} and Drain Efficiency

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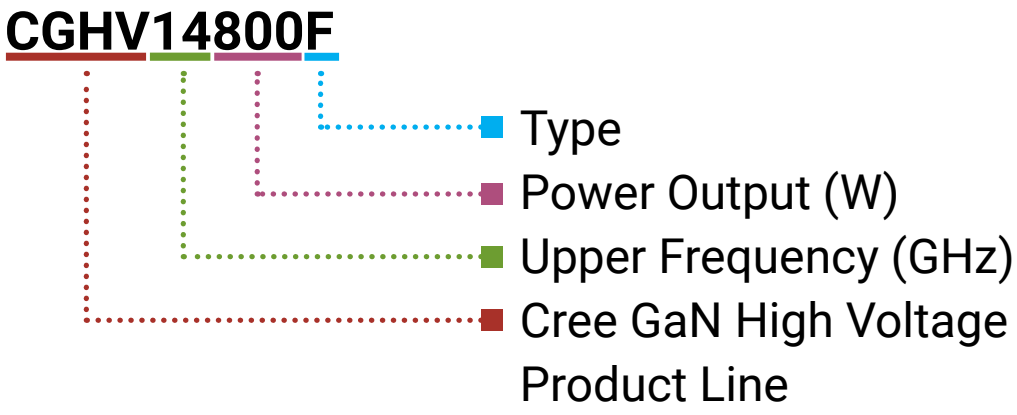
Part Number System



Parameter	Value	Units
Upper Frequency[1]	1.4	GHz
Power Output	800	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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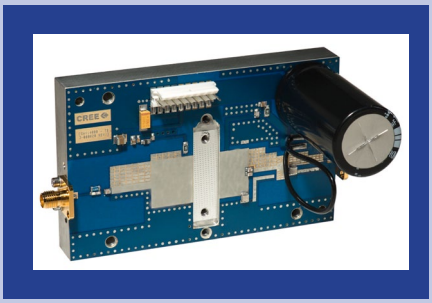
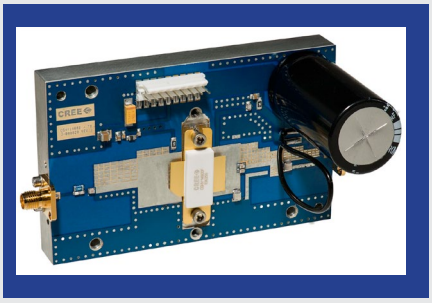
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV14800F	GaN HEMT	Each	
CGHV14800-TB	Test board without GaN HEMT	Each	
CGHV14800F-AMP	Test board with GaN HEMT installed	Each	

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