

CGHV14800

800 W, 960 - 1400 MHz, 50 V, GaN HEMT for L-Band Radar Systems

Description

WolfSpeed'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 960 - 1400 MHz 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 GaN HEMT comes in a ceramic/metal flange package.



Package Type: 440117
PN: CGHV14800F

Typical Performance Over 1.2 - 1.4 GHz ($T_c = 25^\circ\text{C}$) 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
Gain	15.5	15.2	15.2	15.1	15.1	dB
Drain Efficiency	74	73	73	69	67	%

Note: Measured in the CGHV14800F-AMP amplifier circuit, under 100µsecs 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}	150	V	25°C
Gate-to-Source Voltage	V_{GS}	-10, +2		
Storage Temperature	T_{STG}	-65, +150	°C	
Operating Junction Temperature	T_J	225		
Maximum Forward Gate Current	I_{GMAX}	132	mA	25°C
Maximum Drain Current ¹	I_{DMAX}	24		
Maximum Duty Cycle	D	5	%	
Soldering Temperature ²	T_S	245	°C	
Screw Torque	τ	40	in-oz	
Pulsed Thermal Resistance, Junction to Case ³	$R_{\theta JC}$	0.16	°C/W	$P_{DISS} = 664 \text{ W}, 100\mu\text{sec}, 5\%, 85^\circ\text{C}$
Case Operating Temperature ⁴	T_C	-40, +100	°C	$P_{DISS} = 664 \text{ W}, 100\mu\text{sec}, 5\%$

Notes:

¹ Current limit for long term, reliable operation

² Refer to the Application Note on soldering at wolfspeed.com/rf/document-library

³ Measured for the CGHV14800F-AMP

⁴ See also, the Power Dissipation De-rating Curve on Page 7

Electrical Characteristics ($T_C = 25^\circ\text{C}$)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics¹						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V_{DC}	$V_{DS} = 10 \text{ V}, I_D = 132.8 \text{ mA}$
Gate Quiescent Voltage	$V_{GS(Q)}$	—	-2.7	—		$V_{DS} = 50 \text{ V}, I_D = 800 \text{ mA}$
Saturated Drain Current ²	I_{DS}	86.3	123.5	—	A	$V_{DS} = 6.0 \text{ V}, V_{GS} = 2.0 \text{ V}$
Drain-Source Breakdown Voltage	V_{BR}	125	—	—	V_{DC}	$V_{GS} = -8 \text{ V}, I_D = 132.8 \text{ mA}$
RF Characteristics³ ($T_C = 25^\circ\text{C}$, $F_0 = 1.3 \text{ GHz}$ unless otherwise noted)						
Output Power at $f = 1.2 \text{ GHz}$	P_{OUT}	804	977	—	W	$V_{DD} = 50 \text{ V}, I_{DQ} = 800 \text{ mA}, P_{IN} = 44.5 \text{ dBm}$
Output Power at $f = 1.23 \text{ GHz}$		795	933	—		
Output Power at $f = 1.4 \text{ GHz}$		750	912	—		
Drain Efficiency at $f = 1.2 \text{ GHz}$	η	62	71	—	%	
Drain Efficiency at $f = 1.23 \text{ GHz}$		63		—		
Drain Efficiency at $f = 1.4 \text{ GHz}$		57	67	—		
Pulsed Amplitude Droop	D	—	-0.3	—	dB	$V_{DD} = 50 \text{ V}, I_{DQ} = 800 \text{ mA}$
Output Mismatch Stress	VSWR	—	—	9:1	Ψ	No damage at all phase angles, $V_{DD} = 50 \text{ V}, I_{DQ} = 800 \text{ mA}, P_{IN} = 44.5 \text{ dBm}$ Pulsed
Dynamic Characteristics						
Input Capacitance	C_{GS}	—	326	—	pF	$V_{DS} = 50 \text{ V}, V_{GS} = -8 \text{ V}, f = 1 \text{ MHz}$
Output Capacitance	C_{DS}	—	643	—		
Feedback Capacitance	C_{GD}	—	3.9	—		

Notes:

¹ Measured on wafer prior to packaging

² Scaled from PCM data

³ Measured in CGHV14800F-AMP. Pulsed Width = 100 μs , Duty Cycle = 5%.

Typical Pulsed Performance

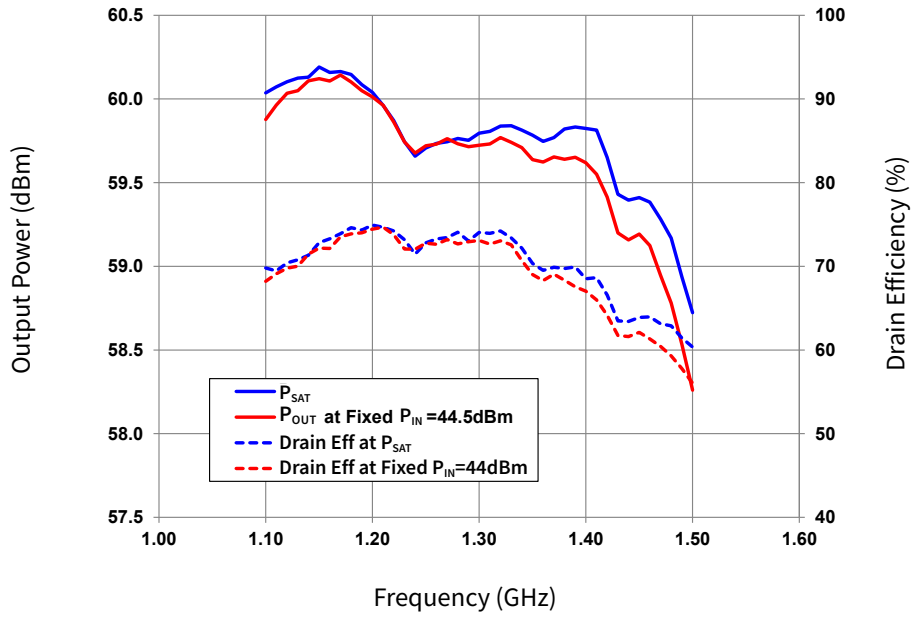


Figure 1. Saturated Output Power and Drain Efficiency vs Frequency of the CGHV14800F in the CGHV14800F-AMP
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 800\text{ mA}$, Pulse Width = $100\mu\text{s}$, Duty Cycle = 5%

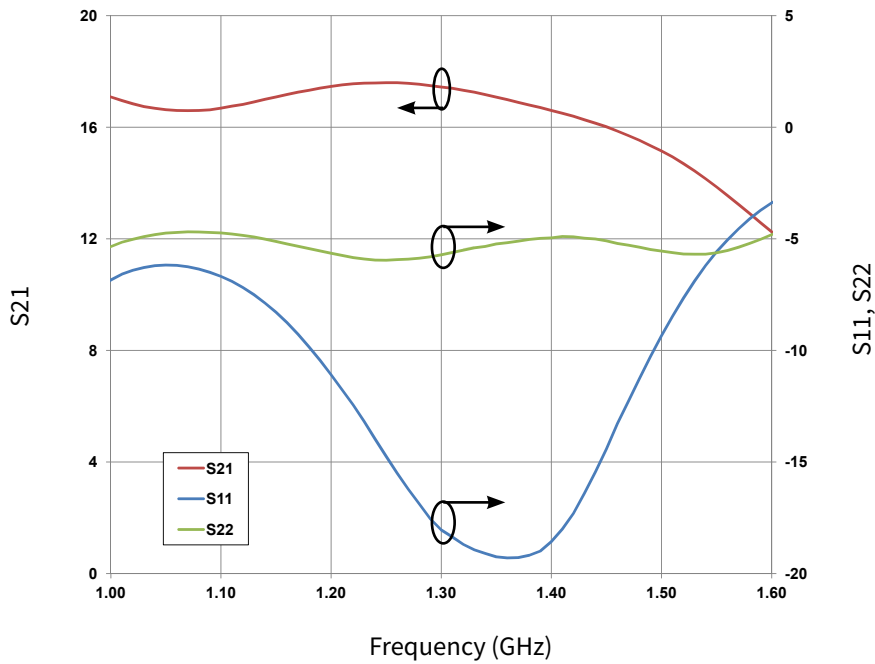


Figure 2. Small Signal Gain and Return Losses vs Frequency of the CGHV14800F in the CGHV14800F-AMP
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 800\text{ mA}$



CGHV14800F-AMP Demonstration Amplifier Circuit Bill of Materials

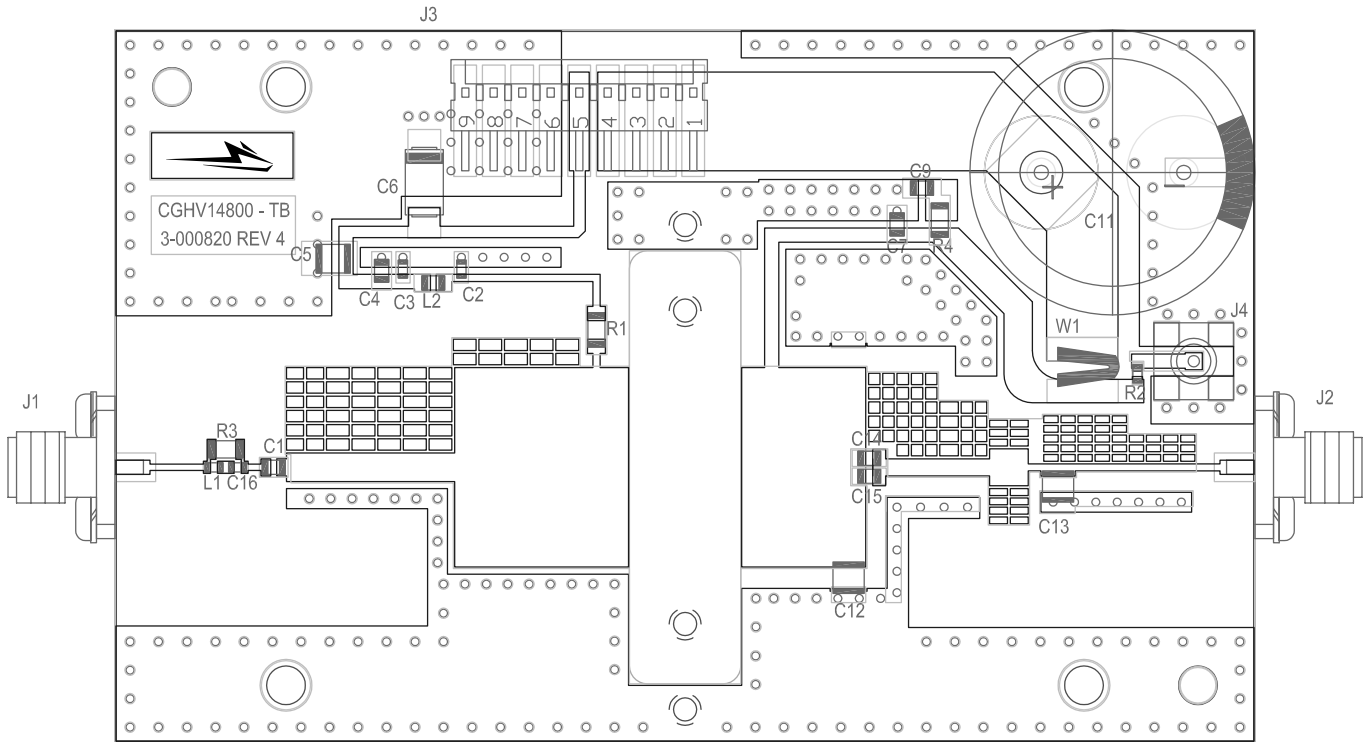
Designator	Description	Qty
R2	RES, 1/16W, 0603, 1%, 4.99K OHMS	1
C3	CAP, 470pF, 5%, 100V, 0603, X7R, ROHS COMPLIANT	1
C5	CAP, 1.0μF, 100V, +/-10%, X7R, 1210	1
C11	CAP, 3300μF, +/-20%, 100V, ELECTROLYTIC, VR, RADIAL	1
C16	CAP, 2.0pF, +/-0.1pF, 0603, ATC	1
C2	CAP, 33pF, +/-5%, 0603, ATC	1
C4,C9	CAP, 33000pF, 0805, 100V, X7R	2
C1	CAP, 100pF +/- 5%, 250V, 0805, ATC 600F	1
C7	CAP, 33pF +/- 5%, 250V, 0805, ATC 600F	1
	PCB, TMM10i, 0.025" THK, CGHV14800F-TB	1
	BASEPLATE, AL, 4.00 X 2.50 X 0.49, ALTERNATE HOLE PATTERN	1
	2-56 SOC HD SCREW 1/4 SS	4
	#2 SPLIT LOCKWASHER SS	4
J1,J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
L1	INDUCTOR, CHIP, 6.8nH, 0603 SMT	1
W1	WIRE, BLACK, 18 AWG, EXTRUDED TFE TEFLON	1
J4	CONN, SMB, STRAIGHT JACK RECEPTACLE, SMT, 50 OHM, Au PLATED	1
C6	CAP 10μF 16V TANTALUM, 2312	1
R1,R4	RES,5.1 OHM, SMT, 1206, 125MW, 5%	2
R3	RES, 1/4W, 1206 1% 536 OHM	1
L2	IND, FERRITE, 220 OHM, 0805	1
C13	CAP, 3.0pF, ATC800B, +/-0.1pF	1
C12	CAP, 2.0pF, ATC800B, +/-0.1pF	1
C14,C15	CAP, 3.9pF, +/-0.1pF, 250V, 0805, ATC600F	2
Q1	CGHV14800F	1

Electrostatic Discharge (ESD) Classifications

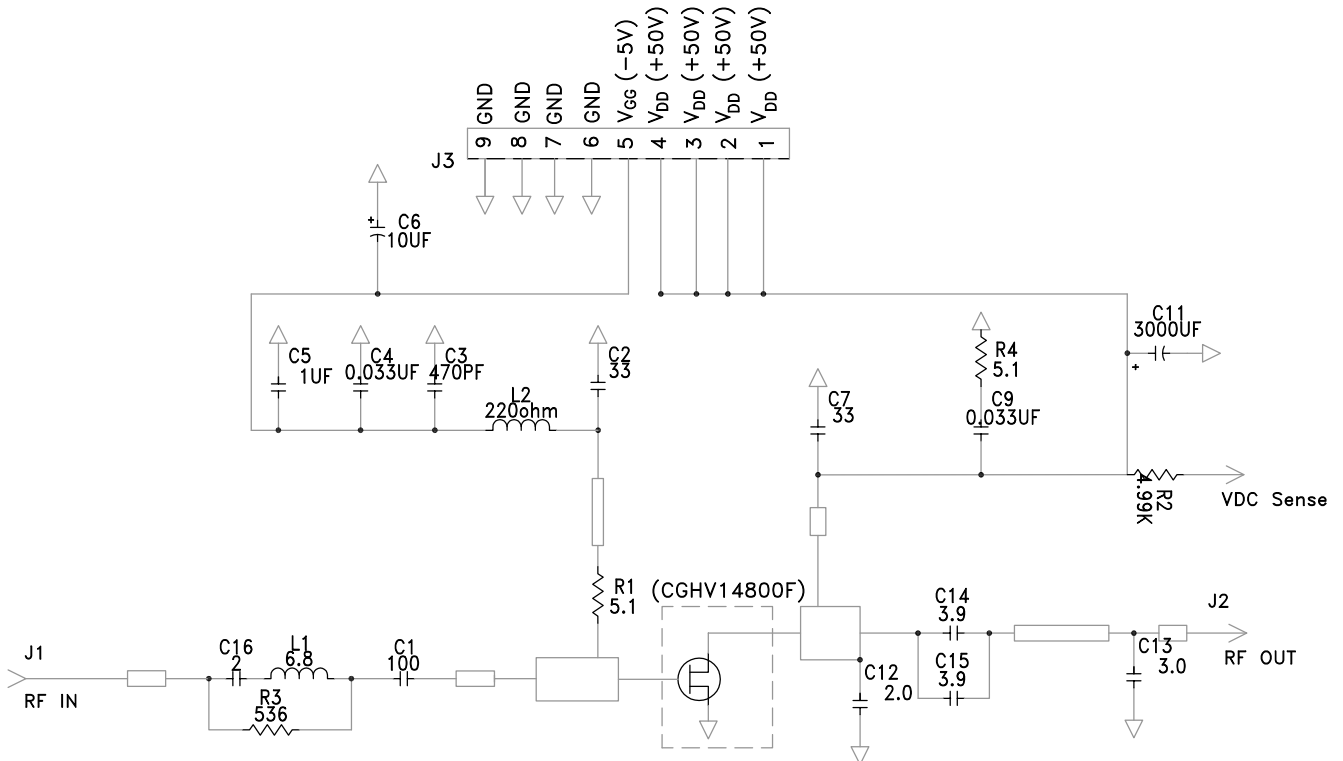
Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	2	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	C3	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C



CGHV14800-AMP Demonstration Amplifier Circuit Outline

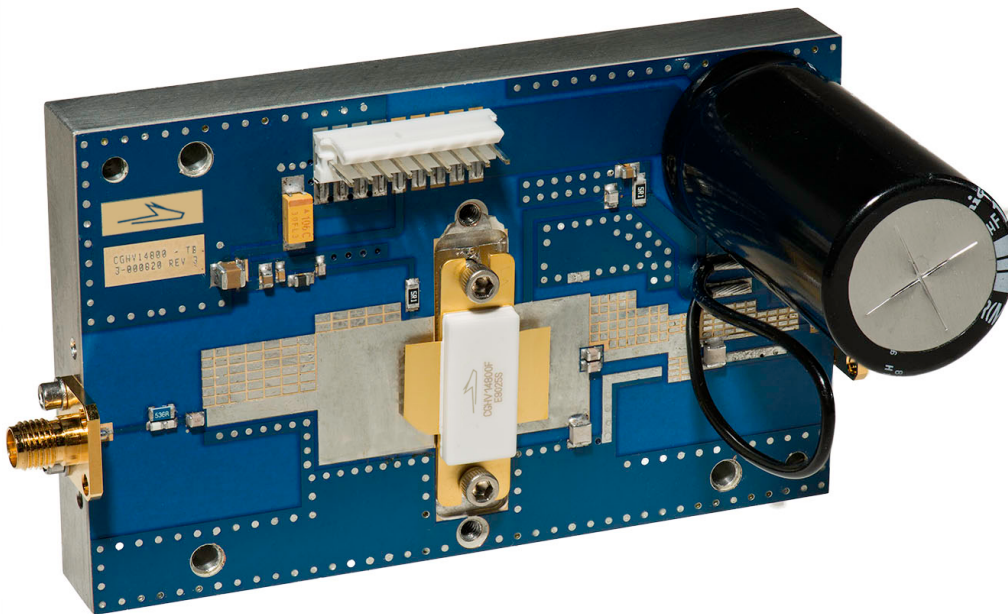


CGHV14800-AMP Demonstration Amplifier Circuit Schematic

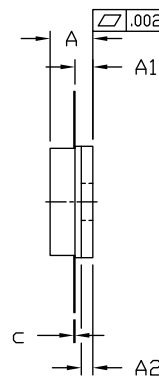
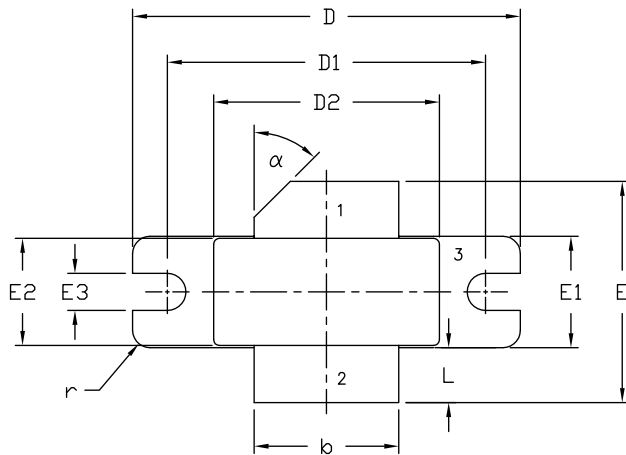




CGHV14800F-AMP Demonstration Amplifier Circuit



Product Dimensions CGHV14800F (Package Type – 440117)



NOTES:

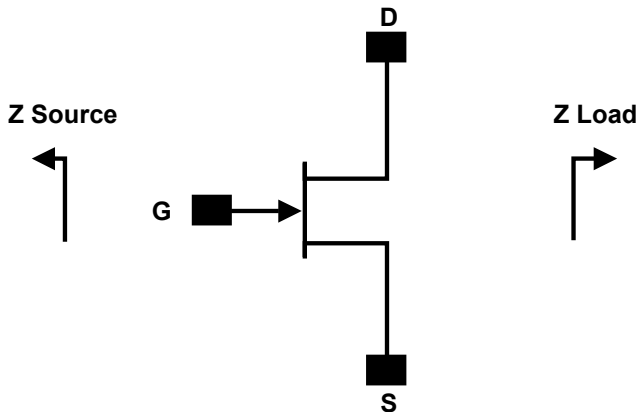
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M – 1994.
2. CONTROLLING DIMENSION: INCH.
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
4. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

DIM	INCHES		MILLIMETERS		NOTES
	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	

- PIN 1. GATE
 2. DRAIN
 3. SOURCE



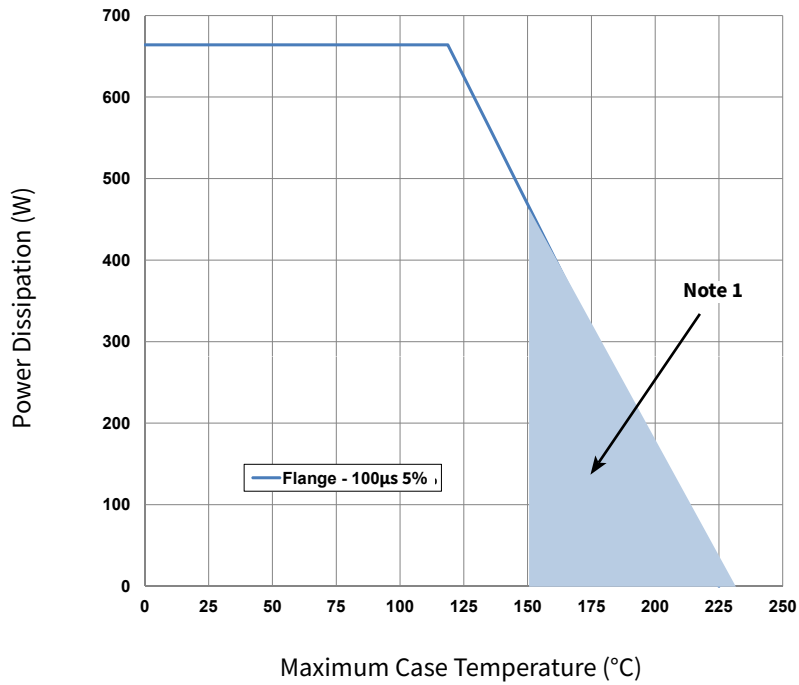
Source and Load Impedances



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	116 - 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

Notes:
¹ $V_{DD} = 50\text{ V}$, $I_{DQ} = 800\text{ mA}$ in the 440117 package.
² Optimized for power gain, P_{SAT} and Drain Efficiency

CGHV14800F Power Dissipation De-rating Curve



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



Part Number System

CGHV14800F

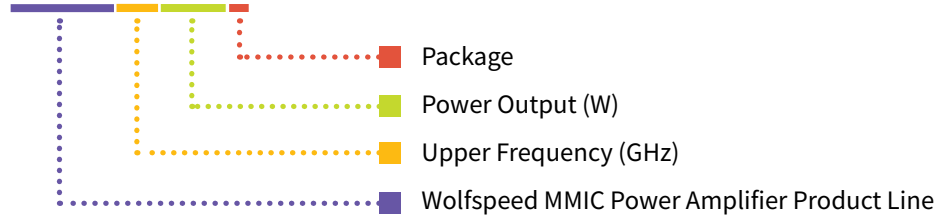


Table 1.

Parameter	Value	Units
Upper Frequency ¹	1.4	GHz
Power Output	800	W
Type	F = Flanged	—

Note:


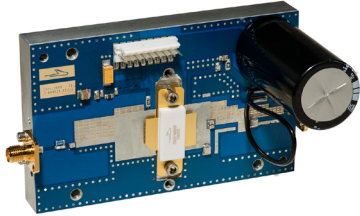
¹ Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

Table 2.

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



Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV14800F	GaN HEMT	Each	 A photograph of a GaN HEMT device. It consists of a white rectangular chip with gold-colored leads on the left and right sides. The chip has the text "CGHV14800F" and "C07768SS" printed on it.
CGHV14800F-AMP	Test board with GaN HEMT installed, 1.2 - 1.4 GHz	Each	 A photograph of a blue printed circuit board (PCB) test board. It features a central GaN HEMT device, various electronic components, and a large black cylindrical component on the right side. The board has several connectors and mounting holes.

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