

CGHV37400F

400 W, 3.5 - 3.7 GHz, 50-Ohm Input/Output Matched,
GaN HEMT for S-Band Radar Systems

Description

Cree's CGHV37400F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV37400F ideal for 3.5 - 3.7 GHz S-Band radar amplifier applications. The transistor is matched to 50-ohms on the input and 50-ohms on the output. The CGHV35400 is based on Cree's high power density 50 V, 0.4 μ m GaN on silicon carbide (SiC) foundry process. The transistor is supplied in a ceramic metal flange package, type 440217.



PN: CGHV37400F
Package Type: 440217

Typical Performance Over 3.5-3.7 GHz ($T_c = 25^\circ C$) of Demonstration Amplifier

Parameter	3.5 GHz	3.6 GHz	3.7 GHz	Units
Output Power	555	560	555	W
Gain	11.4	11.5	11.4	dB
Drain Efficiency	55	55	55	%

Note: Measured in the CGHV37400F-AMP application circuit, under 100 μ s pulse width, 10% duty cycle, $P_{IN} = 46$ dBm

Features

- 3.3 - 3.8 GHz Operation
- 525 W Typical Output Power
- 11.5 dB Power Gain
- 55% Typical Drain Efficiency
- 50 Ohm Internally Matched
- <0.3 dB Pulsed Amplitude Droop



Large Signal Models Available for ADS and MWO

RoHS
COMPLIANT



Absolute Maximum Ratings (not simultaneous)

Parameter	Symbol	Rating	Units	Conditions
Pulse Width	PW	100	μs	
Duty Cycle	DC	10	%	
Drain-Source Voltage	V_{DSS}	150	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, $P_{DISS} = 418$ 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 wolfspeed.com/rf/document-library

Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics¹ ($T_c = 25$ °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, $I_D = 1$ A
Saturated Drain Current ²	I_{DS}	54.3	77.7	-	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	V_{BR}	125	-	-	V_{DC}	$V_{GS} = -8$ V, $I_D = 83.6$ mA
RF Characteristics³ ($T_c = 25$ °C, $F_0 = 3.5$ - 3.7 GHz unless otherwise noted)						
Output Power at 3.5 GHz	P_{OUT1}	400	525	-	W	$V_{DD} = 50$ V, $I_{DQ} = 1000$ mA, $P_{IN} = 46$ dBm
Output Power at 3.7 GHz	P_{OUT2}	400	525	-	W	$V_{DD} = 50$ V, $I_{DQ} = 1000$ mA, $P_{IN} = 46$ dBm
Drain Efficiency at 3.5 GHz	DE_1	50	55	-	%	$V_{DD} = 50$ V, $I_{DQ} = 1000$ mA, $P_{IN} = 46$ dBm
Drain Efficiency at 3.7 GHz	DE_2	50	55	-	%	$V_{DD} = 50$ V, $I_{DQ} = 1000$ mA, $P_{IN} = 46$ dBm
Small Signal Gain	$S21$	11.75	14	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 1000$ mA, $P_{IN} = -10$ dBm
Input Return Loss	$S11$	-	-9	-4	dB	$V_{DD} = 50$ V, $I_{DQ} = 1000$ mA, $P_{IN} = -10$ dBm
Output Return Loss	$S22$	-	-6	-4	dB	$V_{DD} = 50$ V, $I_{DQ} = 1000$ mA, $P_{IN} = -10$ dBm
Amplitude Droop	D	-	-0.3	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 1000$ mA, $P_{IN} = 46$ dBm
Output Stress Match ⁴	VSWR	-	5:1	-	Ψ	No damage at all phase angles, $V_{DD} = 50$ V, $I_{DQ} = 1000$ mA, $P_{IN} = 46$ dBm Pulsed

Notes:

¹ Measured on wafer prior to packaging

² Scaled from PCM data

³ Measured in CGHV37400F-AMP. Pulse Width = 100 μs, Duty Cycle = 10%

⁴ The device is not recommended for 5:1 VSWR applications below 3.3 GHz

Typical Performance

Figure 1. Typical Small Signal Gain and Return Losses vs Frequency
 $V_{DD} = 50 \text{ V}$, $I_{DQ} = 1.0 \text{ A}$

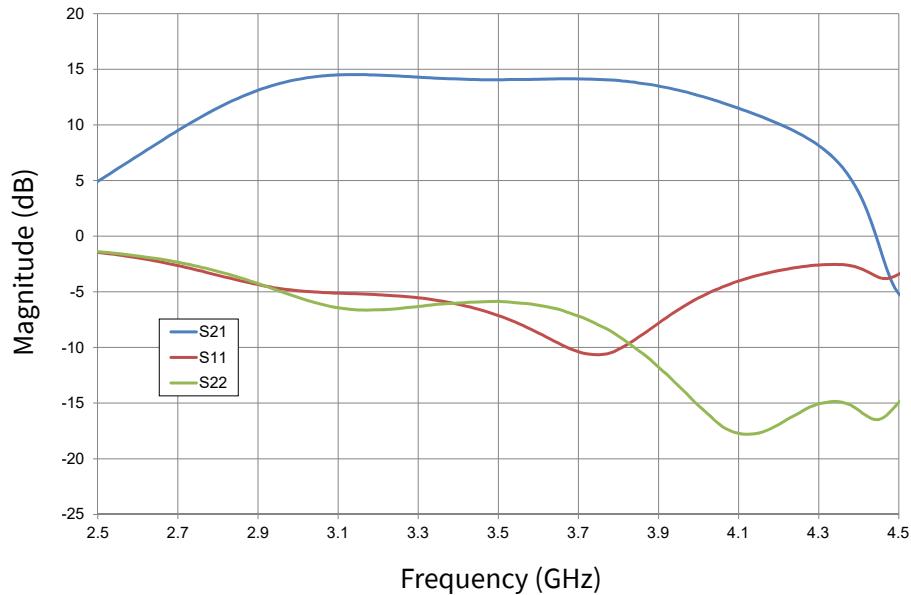
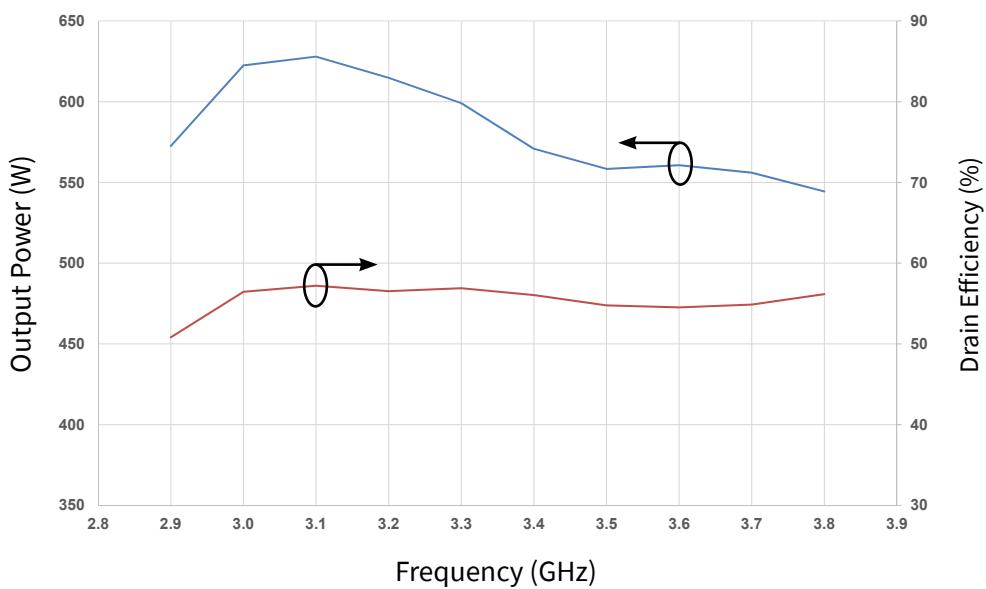


Figure 2. CGHV37400F Output Power and Drain Efficiency vs Frequency
 $V_{DD} = 50 \text{ V}$, $I_{DQ} = 1.0 \text{ A}$, $P_{IN} = 46 \text{ dBm}$, Pulse Width = 100 μs , Duty Cycle = 10%, $T_{CASE} = 25^\circ\text{C}$



Typical Performance

Figure 3. Typical Output Power vs Input Power of the CGHV37400F
 $V_{DD} = 50$ V, $I_{DQ} = 1.0$ A, Pulse Width = 100 μ s, Duty Cycle = 10%, $T_{CASE} = 25$ °C

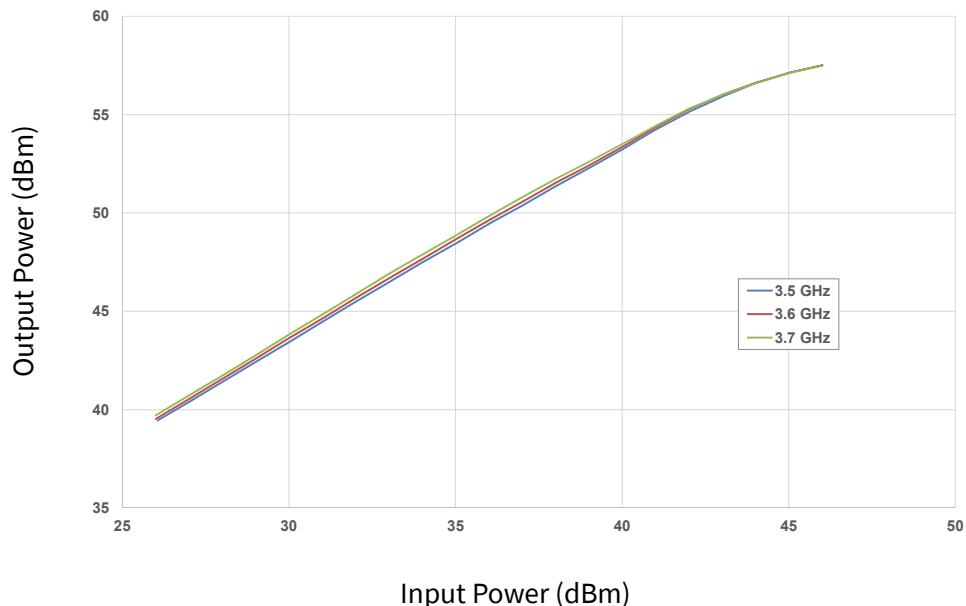
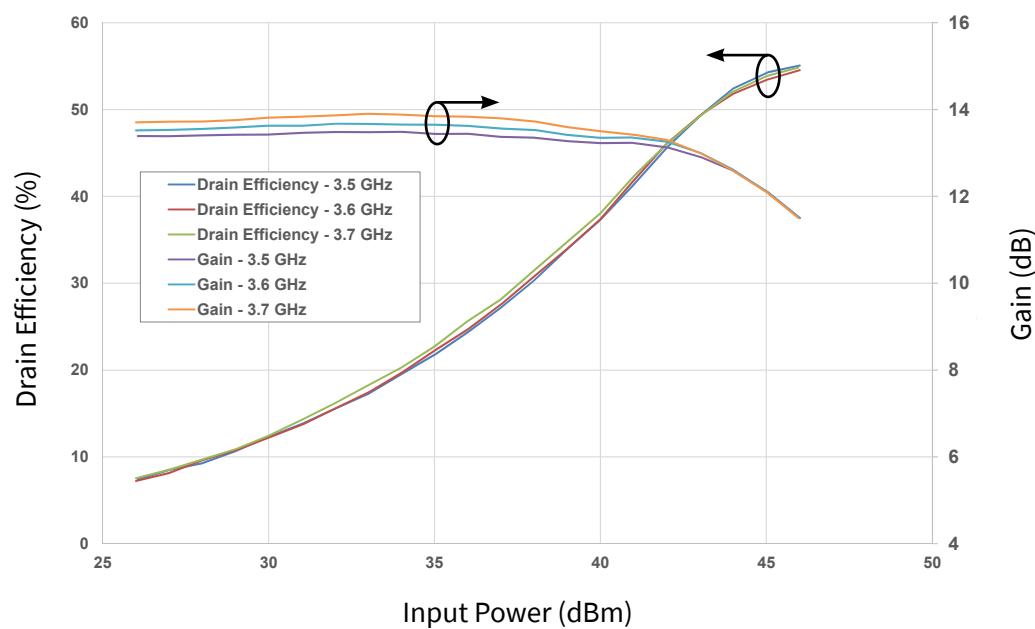


Figure 4. CGHV37400F Drain Efficiency and Gain vs Input Power
 $V_{DD} = 50$ V, $I_{DQ} = 1.0$ A, Pulse Width = 100 μ s, Duty Cycle = 10%, $T_{CASE} = 25$ °C





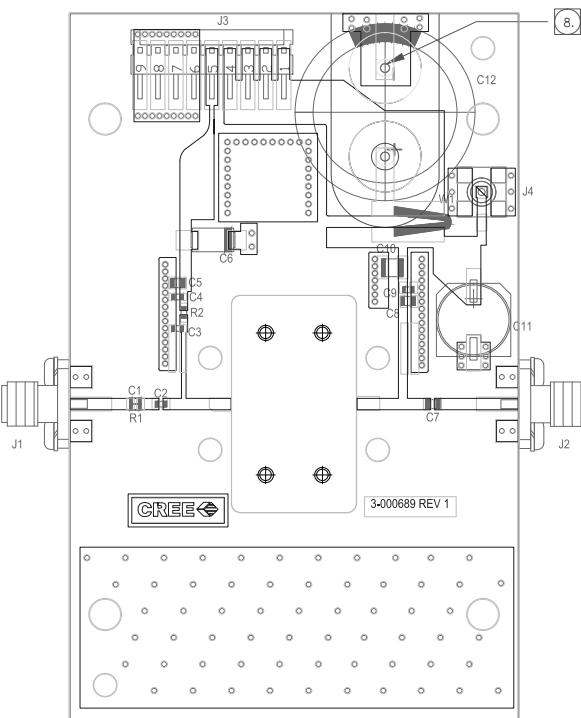
CGHV37400F-AMP Application Circuit Bill of Materials

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	CGHV37400F	1

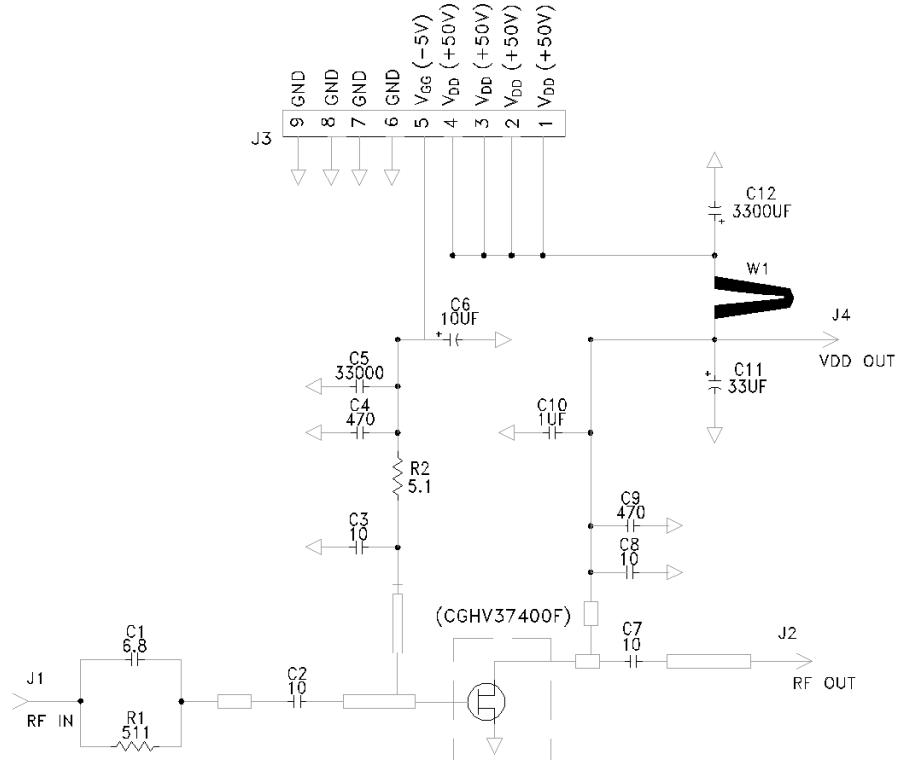
Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	I _A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (200 V < 500 V)	JEDEC JESD22 C101-C

CGHV37400F-AMP Application Circuit Outline



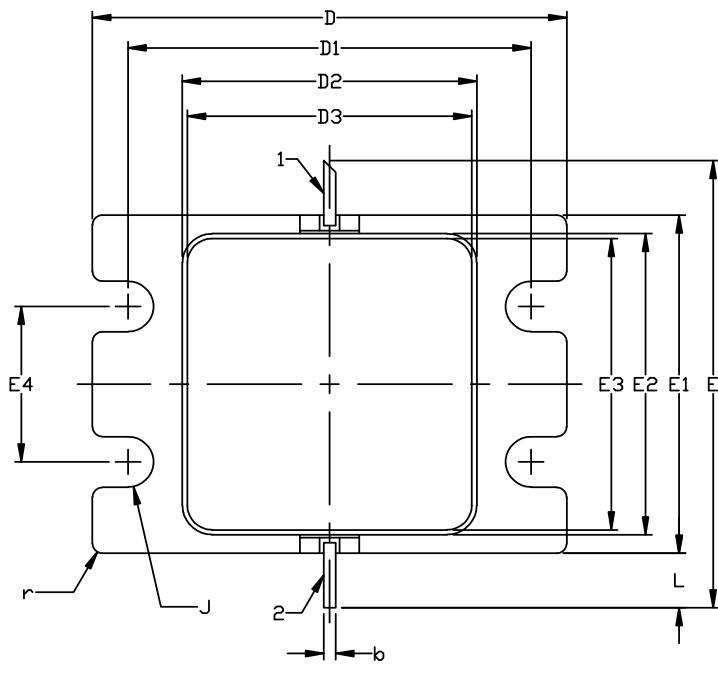
CGHV37400F-AMP Application Circuit Schematic



Product Dimensions CGHV37400F (Package Type – 440217)

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. INTERPRET DRAWING IN ACCORDANCE WITH ANSI Y14.5M-2009
2. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF .020 BEYOND EDGE OF LID
3. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF .008 IN ANY DIRECTION
4. ALL PLATED SURFACES ARE GOLD OVER NICKEL



1. GATE
2. DRAIN

DIM	INCHES		MILLIMETERS		NOTES
	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	12x



Part Number System

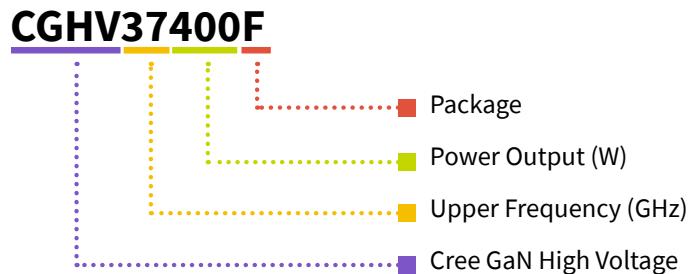


Table 1.

Parameter	Value	Units
Upper Frequency ¹	3.7	GHz
Power Output	400	W
Package	Flange	-

Note¹: 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
CGHV37400F	GaN HEMT	Each	
CGHV37400F-AMP	Test board with GaN HEMT installed	Each	

For more information, please contact:

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Notes

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