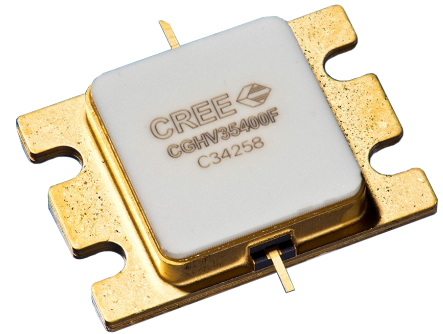


CGHV35400F

400 W, 2.9 - 3.5 GHz, 50-Ohm Input/Output Matched, GaN HEMT for S-Band Radar Systems

Description

Cree's CGHV35400F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV35400F ideal for 2.9 - 3.5 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 μm GaN on silicon carbide (SiC) foundry process. The transistor is supplied in a ceramic/metal flange package, type 440225.



PN: CGHV35400F
Package Type: 440225

Typical Performance Over 2.9-3.5 GHz ($T_c = 25^\circ\text{C}$) of Demonstration Amplifier

Parameter	2.9 GHz	3.2 GHz	3.5 GHz	Units
Output Power	500	535	480	W
Gain	11.0	11.3	10.8	dB
Drain Efficiency	74	69	64	%

Note: Measured in the CGHV35400F-AMP application circuit, under 500 μs pulse width, 10% duty cycle, $P_{IN} = 46\text{ dBm}$.

Features

- 2.9 - 3.5 GHz Operation
- 500 W Typical Output Power
- 11 dB Power Gain
- 70% 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	500	μs	
Duty Cycle	DC	10	%	
Drain-Source Voltage	V_{DS}	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
Pulsed Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.30	°C/W	500 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 Characteristics ¹ ($T_C = 25^\circ\text{C}$)						
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}	125	–	–	V_{DC}	$V_{GS} = -8$ V, $I_D = 83.6$ mA

Notes:

¹ Measured on wafer prior to packaging

² Scaled from PCM data

Electrical Characteristics (Continued)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
RF Characteristics ³ ($T_c = 25^\circ\text{C}$, $F_0 = 2.9 - 3.5\text{ GHz}$ unless otherwise noted)						
Output Power at 2.9 GHz	P_{OUT1}	445	500	–	W	$V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = 46\text{ dBm}$
Output Power at 3.2 GHz	P_{OUT2}	475	535	–	W	$V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = 46\text{ dBm}$
Output Power at 3.5 GHz	P_{OUT3}	410	480	–	W	$V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = 46\text{ dBm}$
Gain at 2.9 GHz	G_{P1}	10.5	11	–	dB	$V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = 46\text{ dBm}$
Gain at 3.2 GHz	G_{P2}	10.75	11.3	–	dB	$V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = 46\text{ dBm}$
Gain at 3.5 GHz	G_{P3}	10.1	10.8	–	dB	$V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = 46\text{ dBm}$
Drain Efficiency at 2.9 GHz	D_{E1}	60	70	–	%	$V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = 46\text{ dBm}$
Drain Efficiency at 3.2 GHz	D_{E2}	60	70	–	%	$V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = 46\text{ dBm}$
Drain Efficiency at 3.5 GHz	D_{E3}	54	64	–	%	$V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = 46\text{ dBm}$
Small Signal Gain	S_{21}	10.5	12	–	dB	$V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = -10\text{ dBm}$
Input Return Loss	S_{11}	–	-8	-3.0	dB	$V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = -10\text{ dBm}$
Output Return Loss	S_{22}	–	-8	-4.0	dB	$V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = -10\text{ dBm}$
Amplitude Droop	D	–	-0.3	–	dB	$V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = 46\text{ dBm}$
Output Stress Match	VSWR	–	5:1	–	Ψ	No damage at all phase angles, $V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, $P_{IN} = 46\text{ dBm}$ Pulsed

Notes:

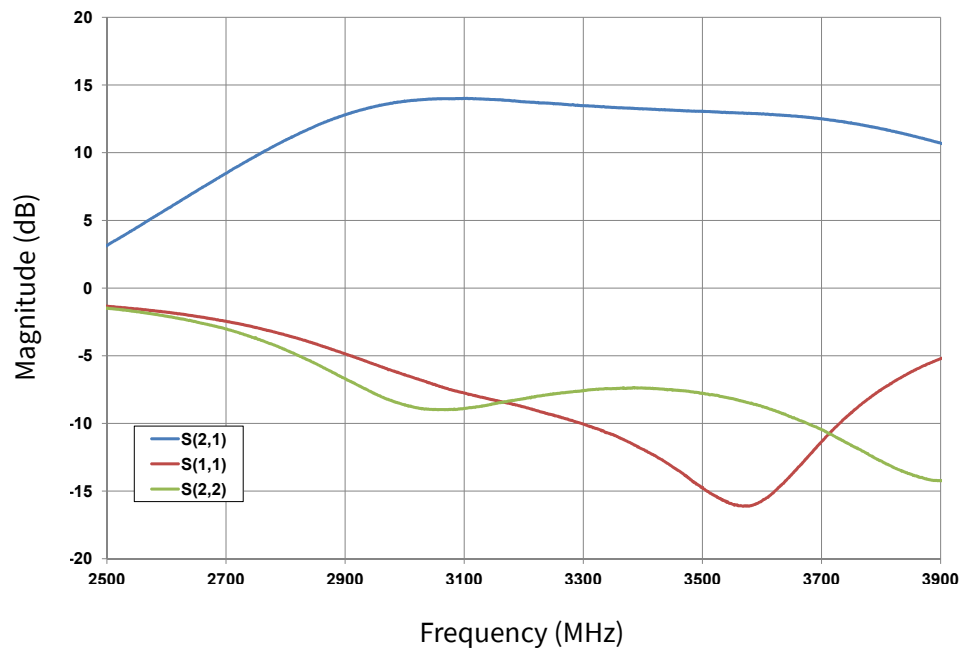
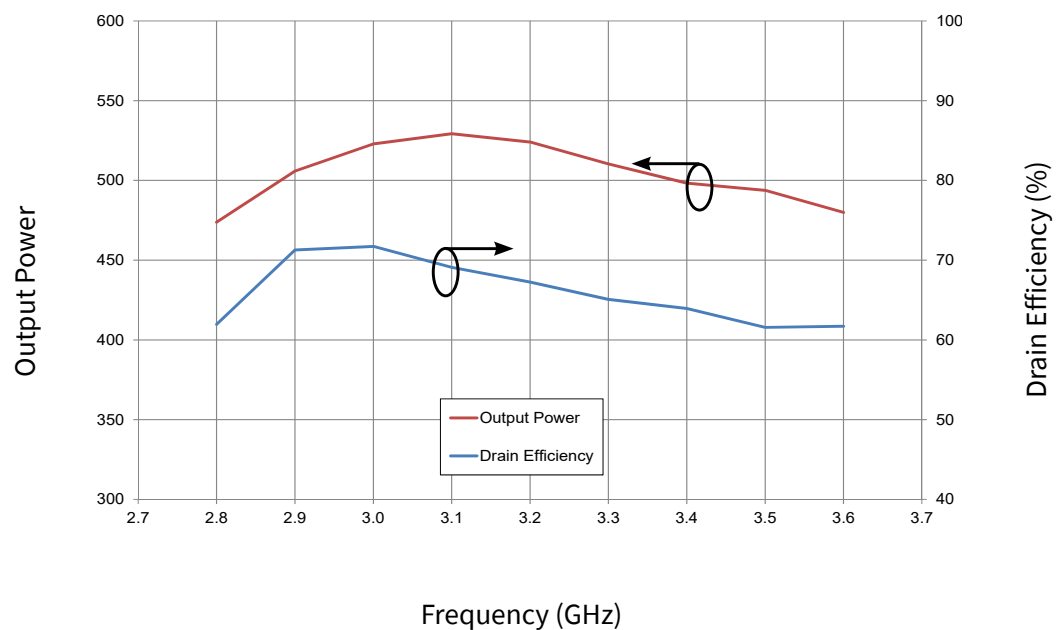
³ Measured in CGHV35400F-AMP. Pulse Width = 500 μs , Duty Cycle = 10%

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (200 < 500V)	JEDEC JESD22 C101-C

Typical Performance

Figure 1. CGHV35400F Typical S Parameters

 $V_{DD} = 50\text{ V}$, $I_{DQ} = 0.5\text{ A}$ Figure 2. CGHV35400F P_{OUT} and Drain Efficiency vs Frequency at $T_{case} = 25^\circ\text{C}$ $V_{DD} = 50\text{ V}$, $I_{DQ} = 0.5\text{ A}$, $P_{IN} = 46\text{ dBm}$, Pulse Width = $500\mu\text{s}$, Duty Cycle = 10%

Typical Performance

Figure 3. CGHV35400F Output Power vs Input Power
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, Pulse Width = $500\text{ }\mu\text{s}$, Duty = 10%, $T_{case} = 25\text{ }^{\circ}\text{C}$

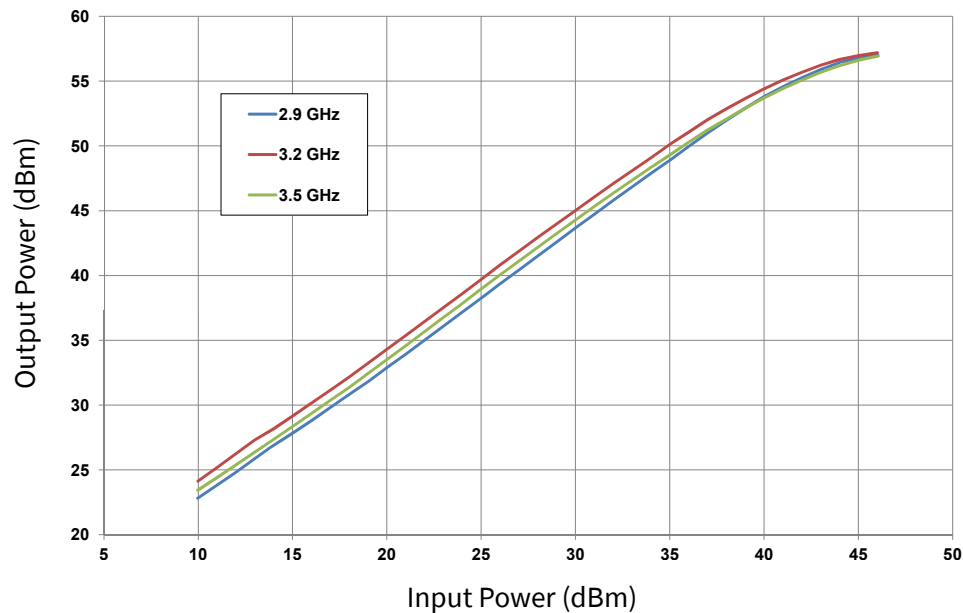
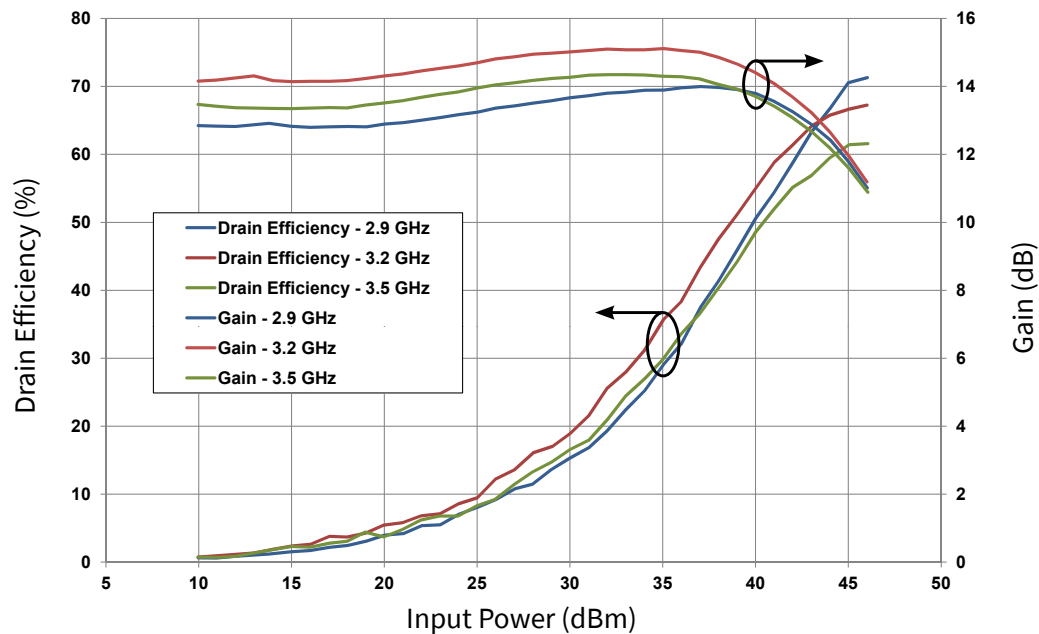


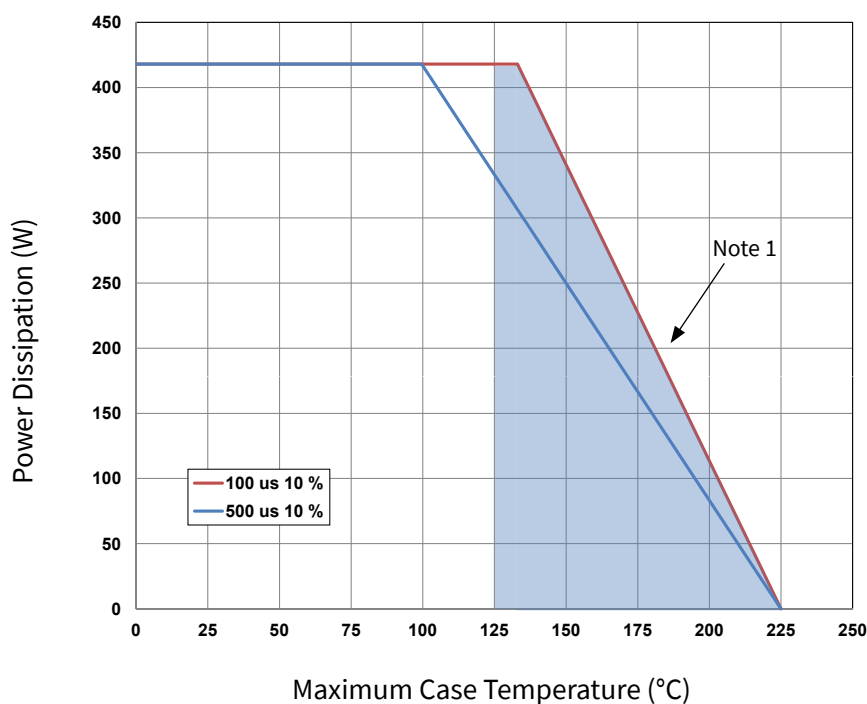
Figure 4. CGHV35400F Drain Efficiency & Gain vs Input Power
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 500\text{ mA}$, Pulse Width = $500\text{ }\mu\text{s}$, Duty Cycle = 10%, $T_{case} = 25\text{ }^{\circ}\text{C}$



CGHV35400F-AMP Application Circuit Bill of Materials

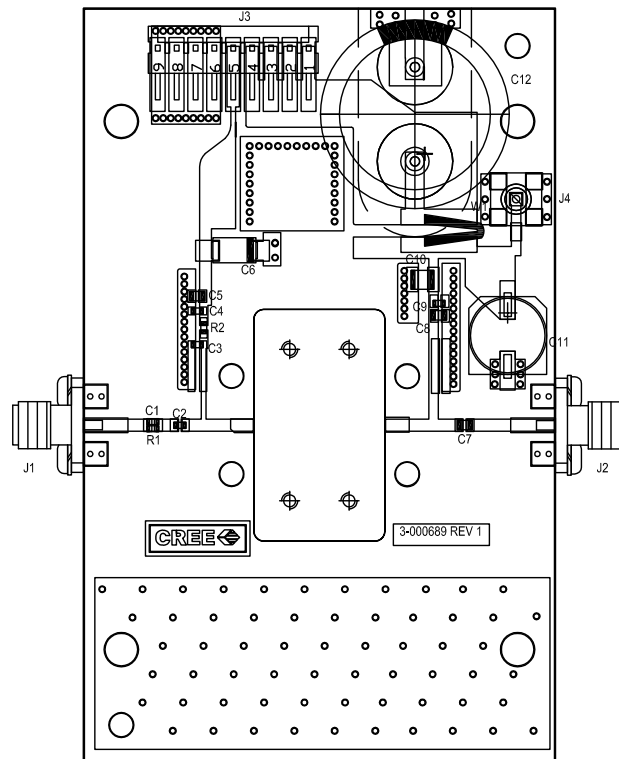
Designator	Description	Qty
R1	RES, 511, OHM, +/- 1%, 1/16W, 0603	1
R2	RES, 5.1, OHM, +/- 1%, 1/16W, 0603	1
C1	CAP, 6.8pF, +/-0.25%, 250V, 0603	1
C2, C7, C8	CAP, 10.0pF, +/-1%, 250V, 0805	3
C3	CAP, 10.0pF, +/-5%, 250V, 0603	1
C4, C9	CAP, 470pF, 5%, 100V, 0603, X	2
C5	CAP, 33000 pF, 0805, 100V, X7R	1
C6	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	CGHV35400F	1

CGHV35400F Power Dissipation De-rating Curve

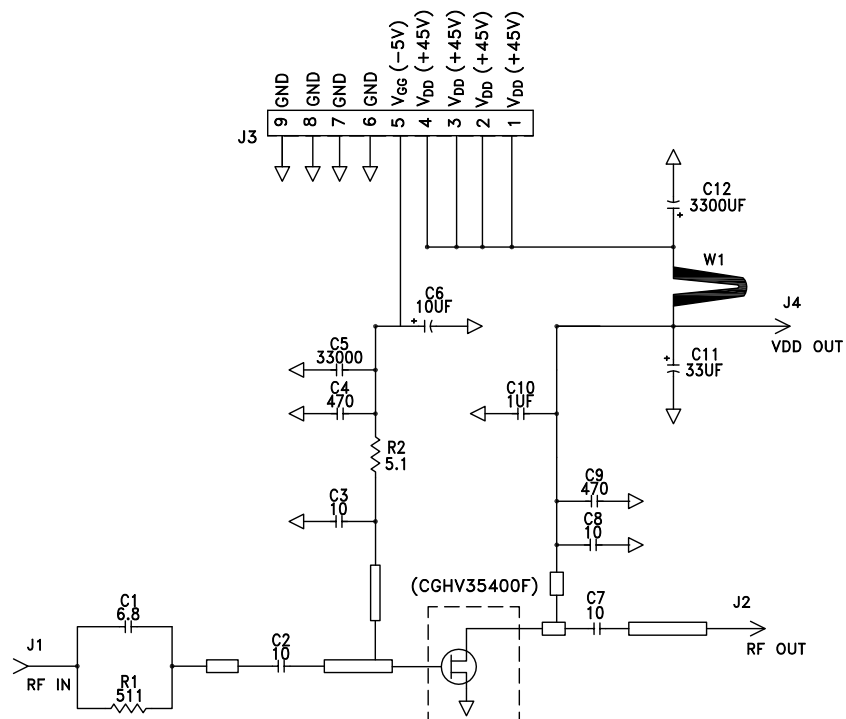


Note 1. Area exceeds Maximum Case Operating Temperature (See Page 2).

CGHV35400F-AMP Application Circuit Outline

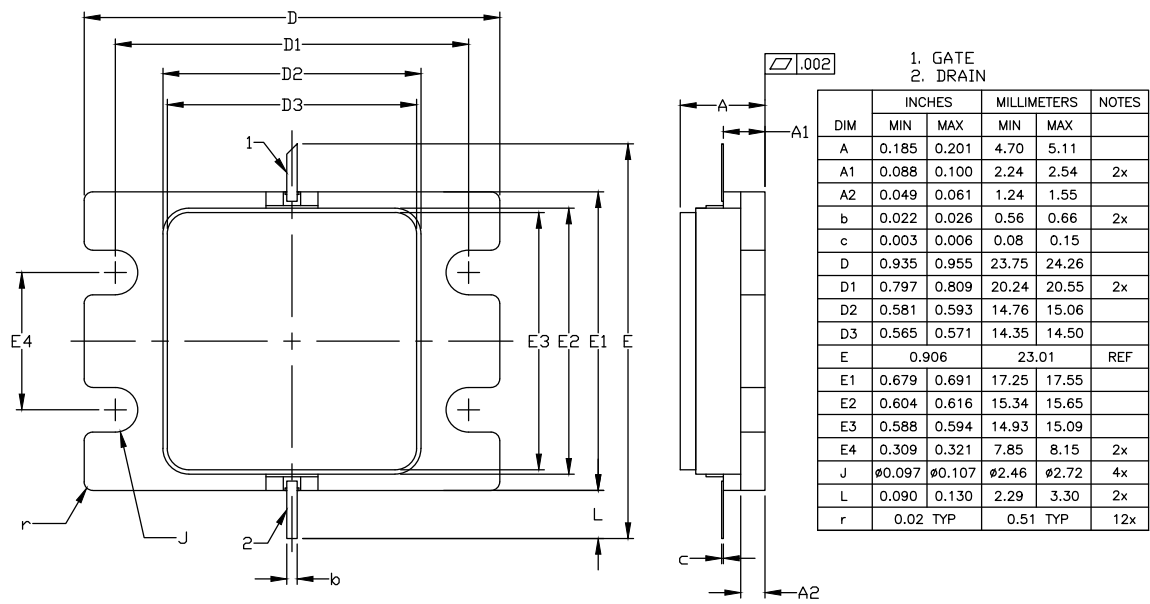


CGHV35400F-AMP Application Circuit Schematic





Product Dimensions CGHV35400F (Package Type — 440225)



Part Number System

CGHV35400F**Table 1.**

Parameter	Value	Units
Upper Frequency ¹	3.5	GHz
Power Output	400	W
Package	Flange	-

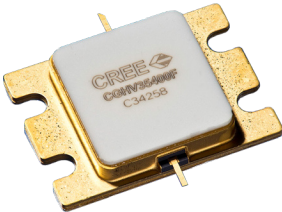
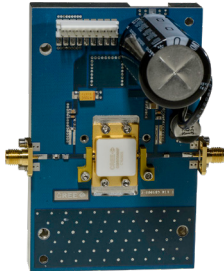
Note¹: Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

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
CGHV35400F	GaN HEMT	Each	
CGHV35400F-AMP	Test board with GaN HEMT installed	Each	

For more information, please contact:

4600 Silicon Drive
Durham, North Carolina, USA 27703
www.wolfspeed.com/RF

Sales Contact
RFSales@cree.com

Notes

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