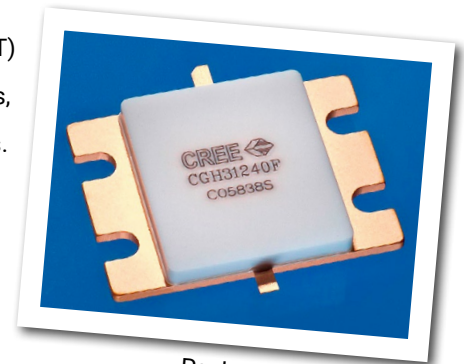


CGH31240F

240 W, 2700-3100 MHz, 50-ohm Input/Output Matched, GaN HEMT for S-Band Radar Systems

Cree's CGH31240F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGH31240F ideal for 2.7-3.1GHz S-Band radar amplifier applications. The transistor is supplied in a ceramic/metal flange package.



Package Type: 440201
PN: CGH31240F

Typical Performance Over 2.7-3.1 GHz ($T_c = 25^\circ\text{C}$) of Demonstration Amplifier

Parameter	2.7 GHz	2.8 GHz	2.9 GHz	3.0 GHz	3.1 GHz	Units
Output Power	243	249	249	245	243	W
Gain	11.9	11.9	11.9	11.9	11.9	dB
Power Added Efficiency	60	61	60	59	52	%

Note:

Measured in the CGH31240F-AMP amplifier circuit, under 300 μs pulse width, 20% duty cycle, $P_{IN} = 42 \text{ dBm}$.

Features

- 2.7 - 3.1 GHz Operation
- 12 dB Power Gain
- 60 % Power Added Efficiency
- < 0.2 dB Pulsed Amplitude Droop

Large Signal Models Available for ADS and MWO

Absolute Maximum Ratings (not simultaneous) at 25°C Case Temperature

Parameter	Symbol	Rating	Units	Conditions
Pulse Width	PW	1	ms	
Duty Cycle	DC	50	%	
Drain-Source Voltage	V_{DSS}	120	Volts	25°C
Gate-to-Source Voltage	V_{GS}	-10, +2	Volts	25°C
Power Dissipation	P_{DISS}	345	Watts	
Storage Temperature	T_{STG}	-65, +150	°C	
Operating Junction Temperature	T_J	225	°C	
Maximum Forward Gate Current	I_{GMAX}	60	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 ³	$R_{\theta JC}$	0.5	°C/W	85°C
Case Operating Temperature ³	T_C	-40, +150	°C	30 seconds

Note:

¹ Current limit for long term, reliable operation

² Refer to the Application Note on soldering at www.cree.com/RF/Document-Library

³ Measured for the CGH31240F at $P_{DISS} = 280$ W. Pulse Width = 300 μ S, Duty Cycle = 20%.

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}	$V_{DS} = 10$ V, $I_D = 57.6$ mA
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	V_{DC}	$V_{DS} = 28$ V, $I_D = 1.0$ A
Saturated Drain Current ²	I_{DS}	46.4	56.0	-	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	V_{BR}	120	-	-	V_{DC}	$V_{GS} = -8$ V, $I_D = 57.6$ mA
RF Characteristics³ ($T_C = 25^\circ\text{C}$, $F_0 = 2.7, 2.9, 3.1$ GHz unless otherwise noted)						
Output Power	P_{OUT}	200	250	-	W	$V_{DD} = 28$ V, $I_{DQ} = 1.0$ A, $P_{IN} = 42$ dBm
Power Added Efficiency ₁ at 2.7 GHz	PAE	49	54	-	%	$V_{DD} = 28$ V, $I_{DQ} = 1.0$ A, $P_{IN} = 42$ dBm
Power Added Efficiency ₂ at 2.9 GHz	PAE	52	58	-	%	$V_{DD} = 28$ V, $I_{DQ} = 1.0$ A, $P_{IN} = 42$ dBm
Power Added Efficiency ₃ at 3.1 GHz	PAE	42	49	-	%	$V_{DD} = 28$ V, $I_{DQ} = 1.0$ A, $P_{IN} = 42$ dBm
Power Gain	G_p	11	12	-	dB	$V_{DD} = 28$ V, $I_{DQ} = 1.0$ A, $P_{IN} = 42$ dBm
Small Signal Gain	S21	14	16	-	dB	$V_{DD} = 28$ V, $I_{DQ} = 1.0$ A, $P_{IN} = -10$ dBm
Input Return Loss	S11	-	-12	-8.0	dB	$V_{DD} = 28$ V, $I_{DQ} = 1.0$ A, $P_{IN} = -10$ dBm
Output Return Loss	S22	-	-6.0	-4.5	dB	$V_{DD} = 28$ V, $I_{DQ} = 1.0$ A, $P_{IN} = -10$ dBm
Pulsed Amplitude Droop	D	-	0.15	-	dB	$V_{DD} = 28$ V, $I_{DQ} = 1.0$ A

Notes:

¹ Measured on wafer prior to packaging.

² Scaled from PCM data.

³ Measured in CGH31240F-AMP. Pulse Width = 300 μ S, Duty Cycle = 20%.

Typical Performance

Figure 1.- Gain and Return Losses vs Frequency of the CGH31240F Measured in CGH31240F-AMP Amplifier Circuit.

$V_{DS} = 28\text{ V}$, $I_{DS} = 1\text{ A}$

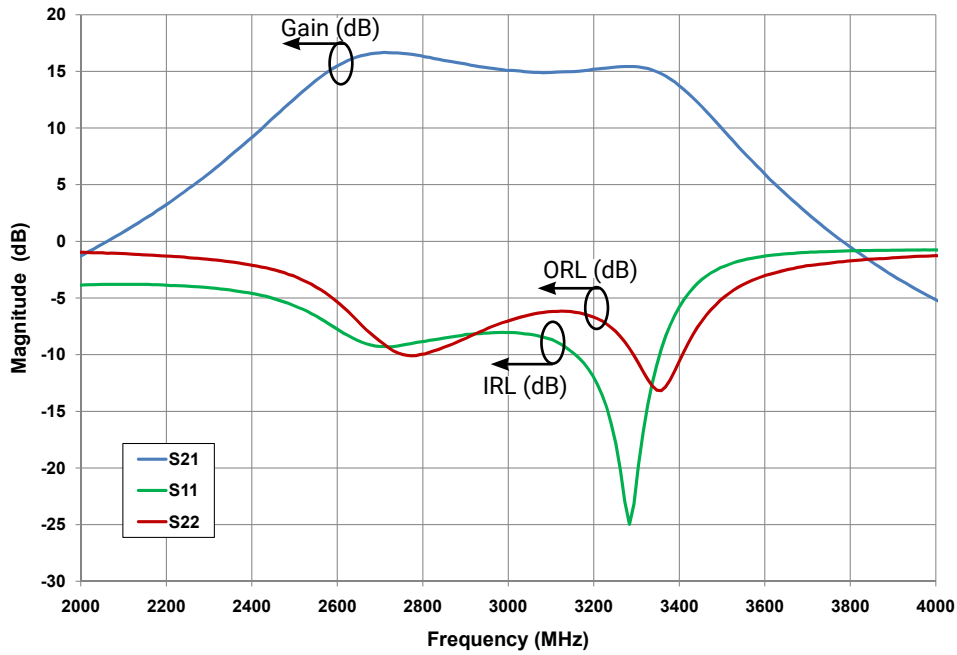
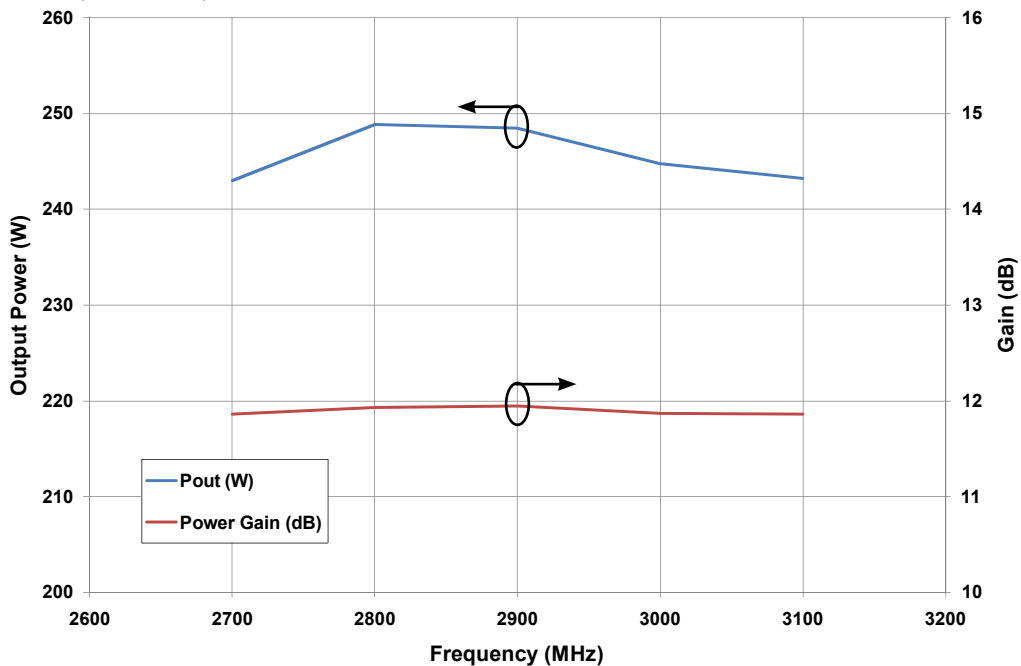


Figure 2.- Typical Pulsed Output Power and Power Gain vs Frequency of the CGH31240F Measured in CGH31240F-AMP Amplifier Circuit.

$V_{DS} = 28\text{ V}$, $I_{DS} = 1\text{ A}$, $P_{IN} = 42\text{ dBm}$, Pulse Width = 300 μs , Duty Cycle = 20%



Typical Performance

Figure 3.- CGH31240 Output Power vs Input Power
 $V_{DS} = 28\text{ V}$, $I_{DS} = 1\text{ A}$, Pulse Width = 300 μS , Duty Cycle = 20 %

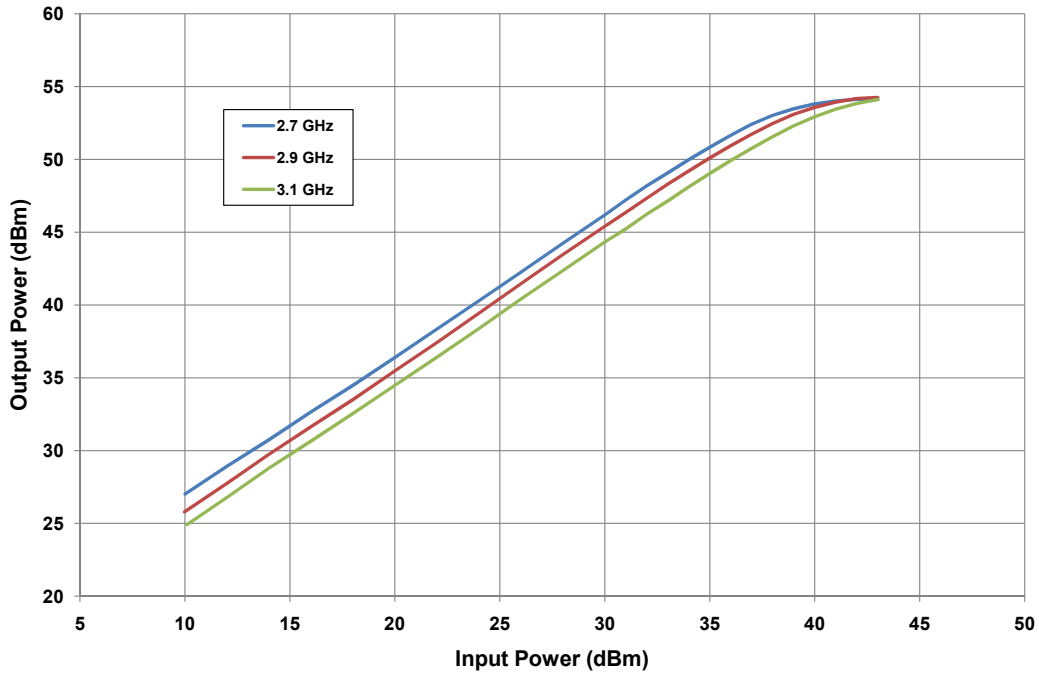
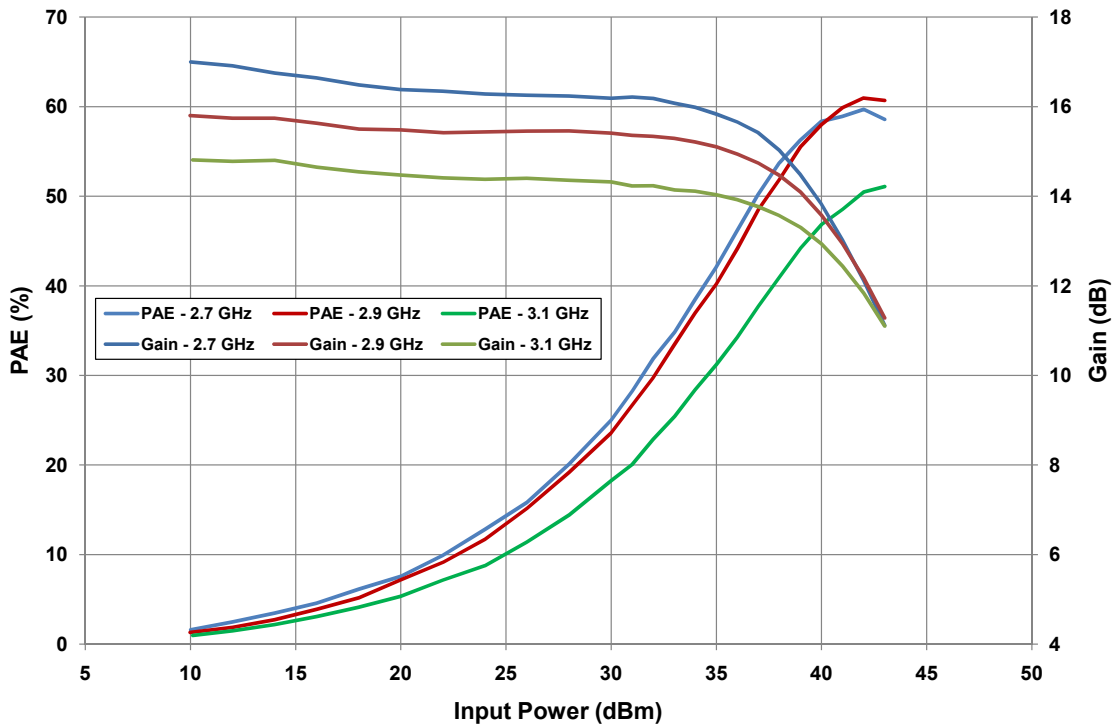


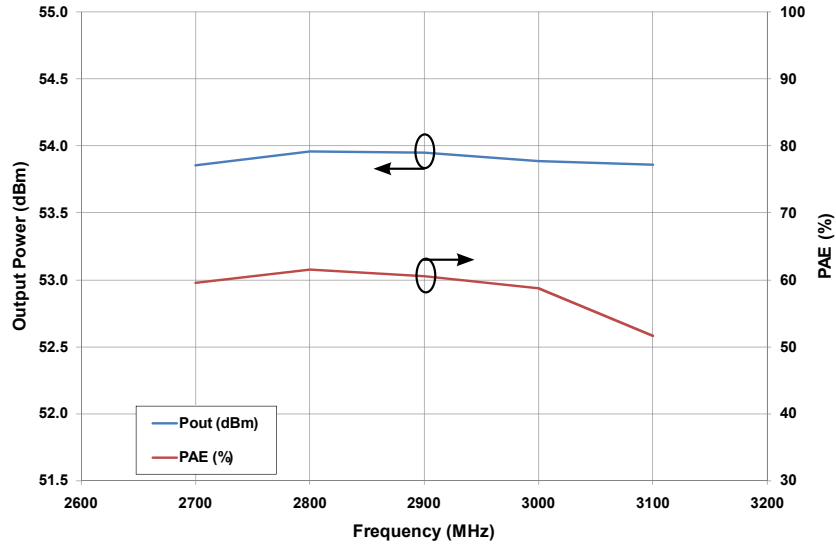
Figure 4.- CGH31240 PAE & Gain vs Input Power
 $V_{DS} = 28\text{ V}$, $I_{DS} = 1\text{ A}$, Pulse Width = 300 μS , Duty Cycle = 20 %



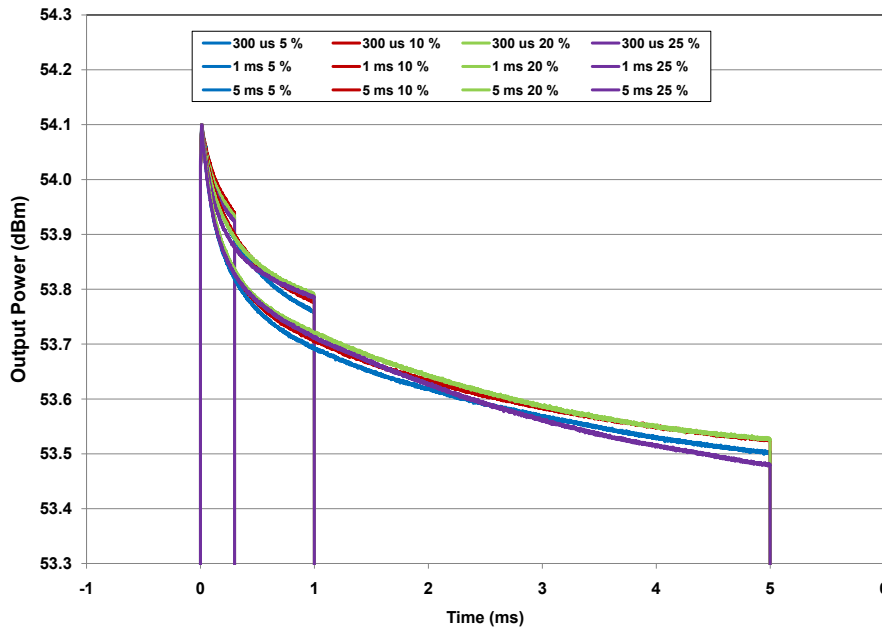
Typical Performance

Figure 5.- Typical Pulsed Output Power and Power Added Efficiency vs Frequency of the CGH31240F Measured in CGH31240F-AMP Amplifier Circuit.

$V_{DS} = 28\text{ V}$, $I_{DS} = 1\text{ A}$, $P_{IN} = 42\text{ dBm}$, Pulse Width = 300 μs , Duty Cycle = 20%



Typical Pulse Droop Performance

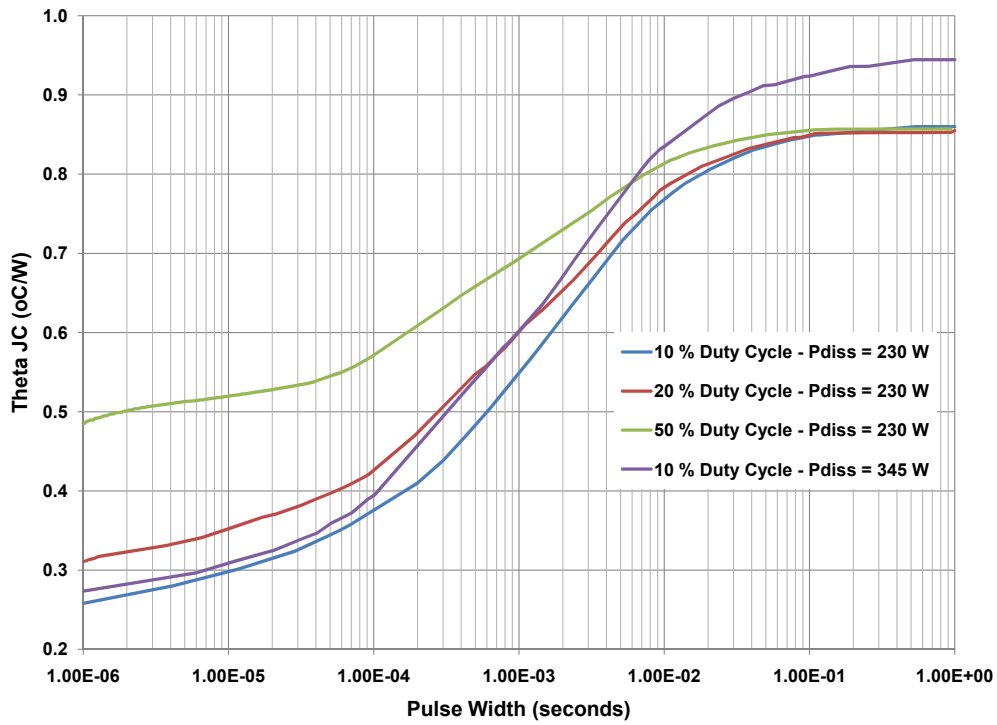


Pulse Width	Duty Cycle (%)	Droop (dB)
10 μs	5-25	0.05
50 μs	5-25	0.05
100 μs	5-25	0.10
300 μs	5-25	0.15
1 ms	5-25	0.30
5 ms	5-25	0.60

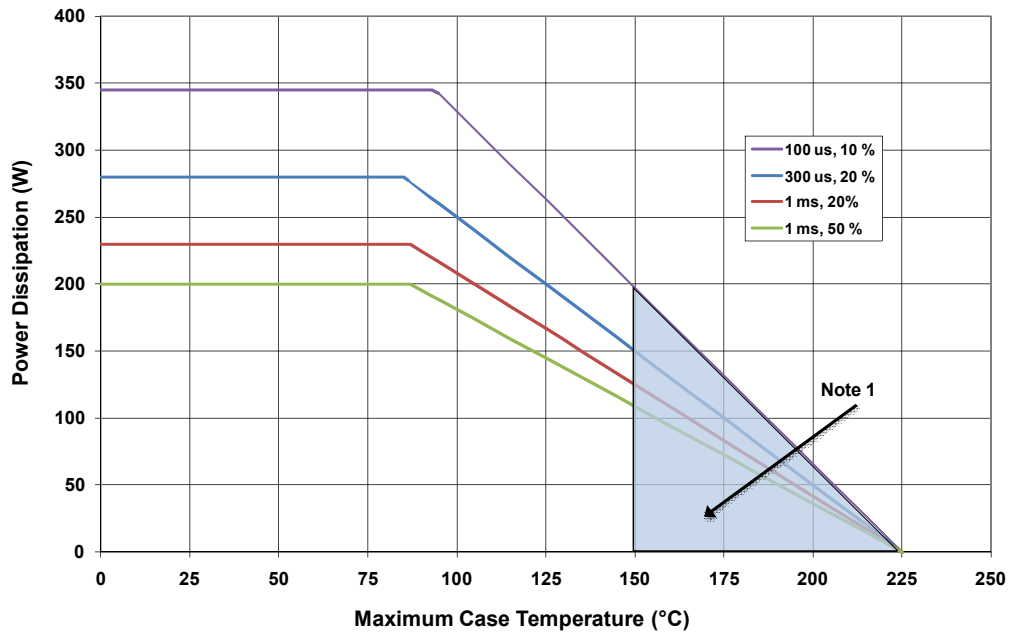
Electrostatic Discharge (ESD) Classifications

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

CGH31240 Pulse Transient Rth



CGH31240 Transient Power Dissipation De-rating Curve



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

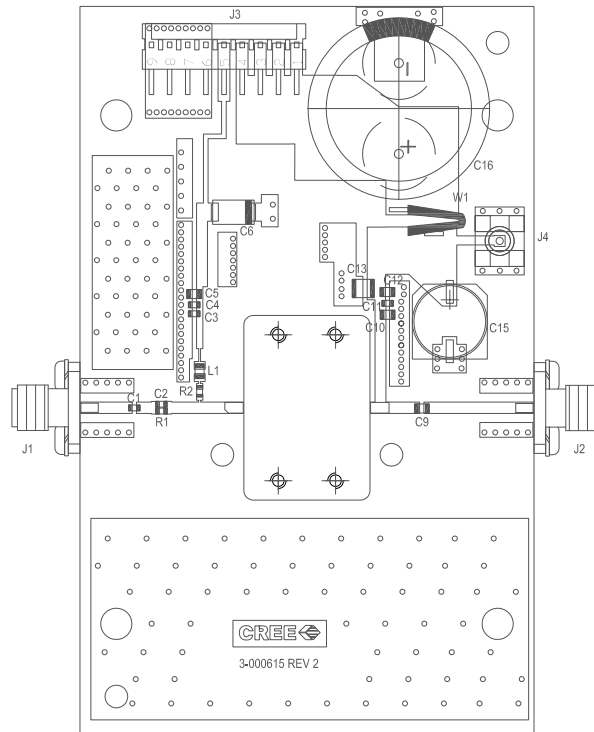
CGH31240F-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 511 OHM, +/- 1%, 1/16W, 0603	1
R2	RES, 5.1, OHM, +/- 1%, 1/16W, 0603	1
C1,C3	CAP, 10.0pF, +/-5%, 250V, 0603, ATC600S	2
C2	CAP, 6.8pF, +/- 0.25 pF, 250V, 0603, ATC600S	1
C4,C11	CAP, 470pF, +/-5%, 100V, 0603, X7R	2
C15	CAP, 33uF, 20%, G CASE	1
C5,C12	CAP, 33000 pF, 0805, 100V, X7R	2
C13	CAP, 1.0uF, 100V, 10%, X7R, 1210	1
C6	CAP, 10uF, 16V, TANTALUM	1
C9,C10	CAP, 10pF, +/- 1%, 250V, 0805	2
C16	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
L1	FERRITE, 22 OHM, 0805, BLM21PG220SN1	1
-	PCB, RO4350, 2.5 X 4.0 X 0.030	1
Q1	CGH31240F	1

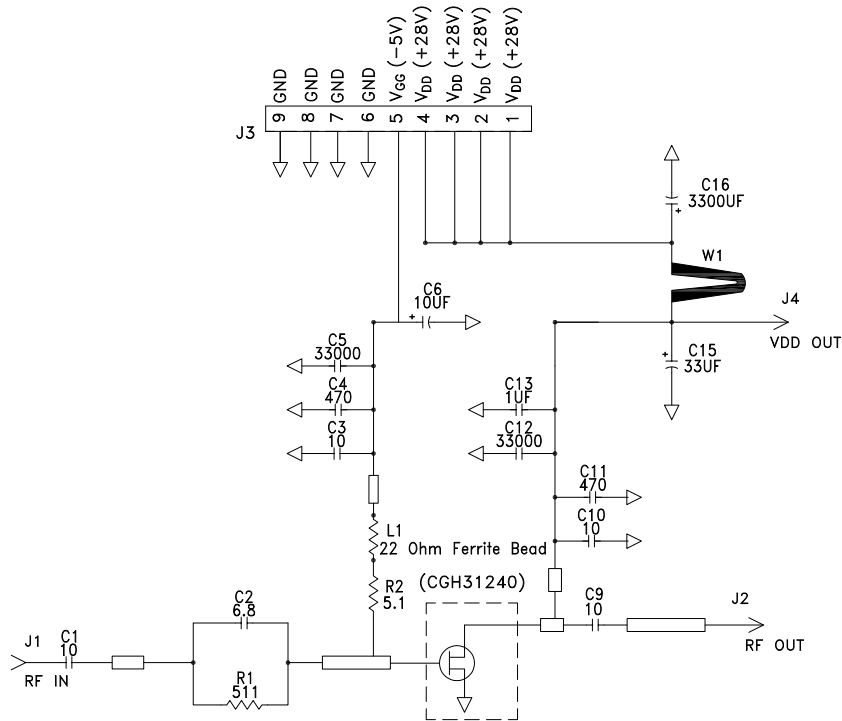
CGH31240F-AMP Demonstration Amplifier Circuit



CGH31240F-AMP Demonstration Amplifier Circuit Outline



CGH31240F-AMP Demonstration Amplifier Circuit Schematic

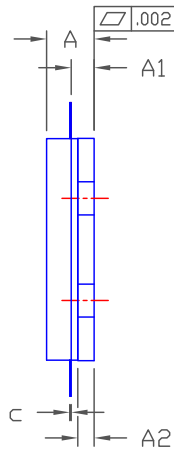
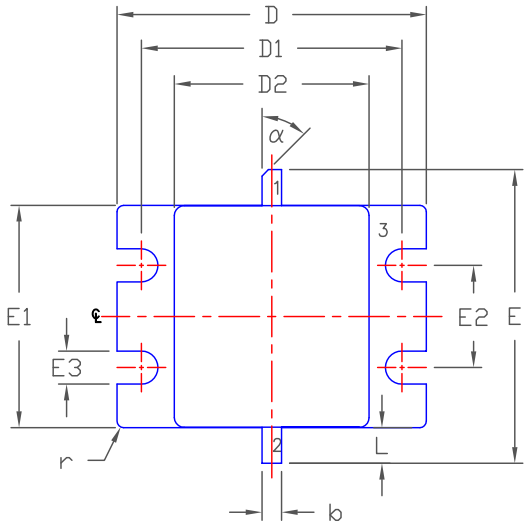


Typical Package S-Parameters for CGH31240F
 (Small Signal, $V_{DS} = 28\text{ V}$, $I_{DQ} = 1000\text{ mA}$, angle in degrees)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.970	170.7	1.73	35.7	0.003	-50.20	0.880	172.0
600 MHz	0.972	167.9	1.42	26.4	0.003	-58.75	0.891	169.5
700 MHz	0.973	165.2	1.21	17.6	0.003	-66.68	0.899	166.8
800 MHz	0.974	162.4	1.07	9.4	0.003	-74.07	0.906	163.9
900 MHz	0.975	159.5	0.96	1.6	0.003	-81.04	0.911	160.9
1.0 GHz	0.975	156.5	0.90	-6.0	0.003	-87.75	0.914	157.6
1.1 GHz	0.974	153.3	0.85	-13.4	0.004	-94.31	0.915	154.2
1.2 GHz	0.974	150.0	0.83	-20.8	0.004	-100.84	0.916	150.6
1.3 GHz	0.973	146.4	0.83	-28.3	0.004	-107.45	0.915	146.8
1.4 GHz	0.971	142.6	0.85	-35.9	0.004	-114.23	0.912	142.6
1.5 GHz	0.969	138.5	0.89	-43.9	0.005	-121.30	0.908	138.0
1.6 GHz	0.966	133.9	0.96	-52.3	0.006	-128.79	0.902	133.0
1.7 GHz	0.963	128.8	1.05	-61.3	0.007	-136.83	0.893	127.4
1.8 GHz	0.958	123.1	1.18	-71.0	0.008	-145.62	0.883	121.1
1.9 GHz	0.951	116.4	1.37	-81.8	0.009	-155.39	0.869	113.7
2.0 GHz	0.940	108.4	1.62	-93.8	0.012	-166.47	0.851	105.1
2.1 GHz	0.924	98.7	1.98	-107.7	0.015	-179.29	0.828	94.6
2.2 GHz	0.899	86.5	2.49	-123.9	0.019	-165.52	0.796	81.7
2.3 GHz	0.857	70.5	3.19	-143.3	0.026	-147.11	0.753	65.3
2.4 GHz	0.786	48.8	4.11	-167.0	0.034	-124.49	0.692	44.1
2.5 GHz	0.677	19.2	5.14	-164.4	0.044	-97.04	0.607	17.1
2.6 GHz	0.544	-19.8	5.99	-132.0	0.053	-65.78	0.507	-14.9
2.7 GHz	0.448	-66.0	6.37	-98.8	0.058	-33.68	0.424	-47.8
2.8 GHz	0.422	-109.5	6.35	-67.2	0.060	-3.29	0.380	-76.4
2.9 GHz	0.427	-143.8	6.19	-37.7	0.060	-25.00	0.369	-99.2
3.0 GHz	0.421	-171.5	6.08	-9.2	0.060	-52.23	0.370	-117.6
3.2 GHz	0.243	120.6	6.20	-53.0	0.064	-111.80	0.279	-141.6
3.4 GHz	0.472	-78.8	4.79	-135.3	0.051	-168.82	0.437	-99.1
3.6 GHz	0.821	-139.7	2.06	-160.3	0.023	-107.35	0.777	-131.3
3.8 GHz	0.897	-168.1	0.91	-121.3	0.010	-71.59	0.877	-153.9
4.0 GHz	0.919	-173.9	0.46	-92.8	0.005	-46.59	0.915	-169.9
4.2 GHz	0.925	-159.9	0.26	-69.5	0.003	-26.99	0.931	-177.2
4.4 GHz	0.925	-147.6	0.16	-49.0	0.002	-10.54	0.937	-165.9
4.6 GHz	0.920	-136.2	0.10	-30.7	0.001	-3.53	0.937	-155.2
4.8 GHz	0.913	-124.8	0.07	-13.6	0.001	-16.16	0.932	-144.6
5.0 GHz	0.903	-113.2	0.05	-2.9	0.001	-27.84	0.923	-133.8
5.2 GHz	0.891	-101.1	0.04	-19.3	0.001	-39.20	0.911	-122.4
5.4 GHz	0.877	-88.0	0.03	-35.8	0.000	-50.53	0.895	-109.8
5.6 GHz	0.860	-73.9	0.03	-52.2	0.000	-61.60	0.875	-95.9
5.8 GHz	0.842	-58.5	0.02	-68.3	0.000	-72.36	0.852	-80.2
6.0 GHz	0.824	-41.6	0.02	-83.9	0.000	-82.61	0.828	-62.1

To download the s-parameters in s2p format, go to the [CGH31240F Product Page](#) and click on the documentation tab.

Product Dimensions CGH31240F (Package Type – 440201)



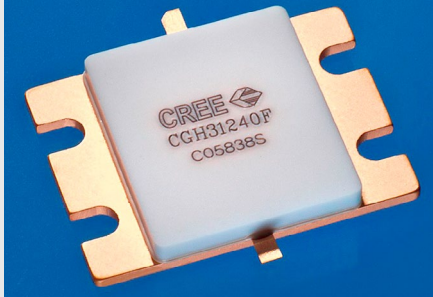
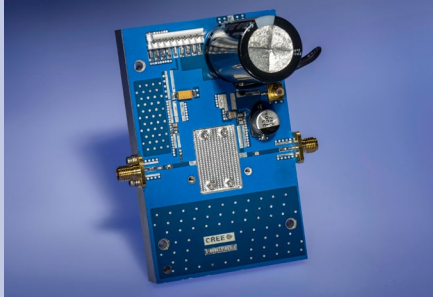
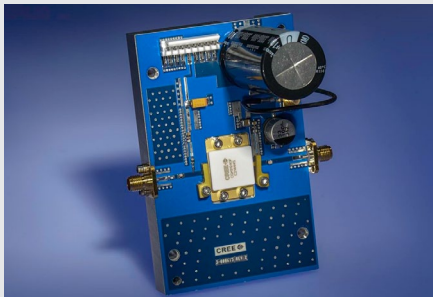
- PIN 1. GATE
 2. DRAIN
 3. SOURCE

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.

DIM	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.128	0.148	3.25	3.76	
A1	0.057	0.067	1.45	1.70	
A2	0.035	0.045	0.89	1.14	
b	0.055	0.065	1.40	1.65	2x
c	0.004	0.007	0.08	0.15	
D	0.948	0.958	24.08	24.33	
D1	0.798	0.808	20.27	20.52	
D2	0.595	0.605	15.11	15.37	
E	0.880	0.930	22.35	23.62	
E1	0.680	0.694	17.27	17.63	
E2	0.310	0.320	7.87	8.13	
E3	0.097	0.107	2.46	2.72	4x
L	0.095	0.125	2.41	3.18	2x
r	0.02 TYP		0.51 TYP		4x
α	45° REF		45° REF		

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGH31240F	GaN HEMT	Each	
CGH31240F-TB	Test board without GaN HEMT	Each	
CGH31240F-AMP	Test board with GaN HEMT installed	Each	



Disclaimer

Specifications are subject to change without notice. Cree, Inc. believes the information contained within this data sheet to be accurate and reliable. However, no responsibility is assumed by Cree for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Cree. Cree makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose. "Typical" parameters are the average values expected by Cree in large quantities and are provided for information purposes only. These values can and do vary in different applications and actual performance can vary over time. All operating parameters should be validated by customer's technical experts for each application. Cree products are not designed, intended or authorized for use as components in applications intended for surgical implant into the body or to support or sustain life, in applications in which the failure of the Cree product could result in personal injury or death or in applications for planning, construction, maintenance or direct operation of a nuclear facility.

For more information, please contact:

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
www.cree.com/RF

Sarah Miller
Marketing & Export
Cree, RF Components
1.919.407.5302

Ryan Baker
Marketing
Cree, RF Components
1.919.407.7816

Tom Dekker
Sales Director
Cree, RF Components
1.919.407.5639