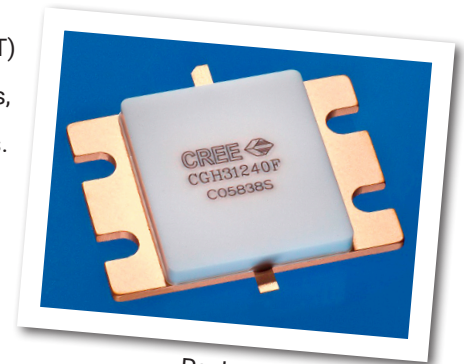


CGH31240F

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-AMP1 amplifier circuit, under 300 μs pulse width, 20% duty cycle, $P_{IN} = 42$ 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-AMP1. Pulse Width = 300 μ S, Duty Cycle = 20%.

Typical Performance

Figure 1.- Gain and Return Losses vs Frequency of the CGH31240F Measured in CGH31240-AMP1 Amplifier Circuit.

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

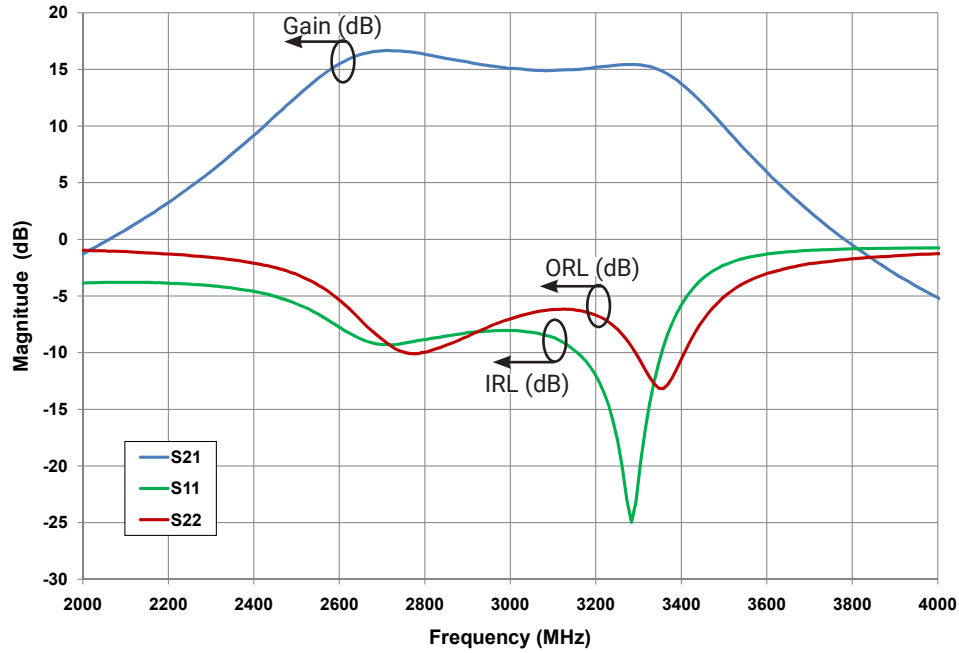
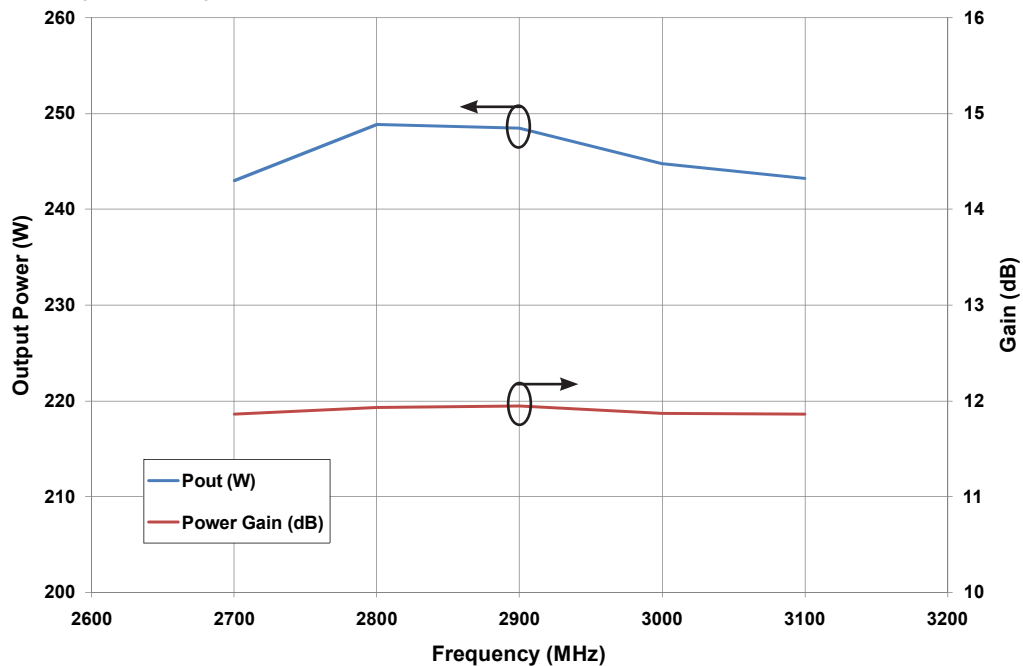


Figure 2.- Typical Pulsed Output Power and Power Gain vs Frequency of the CGH31240F Measured in CGH31240-AMP1 Amplifier Circuit.

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



Typical Performance

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

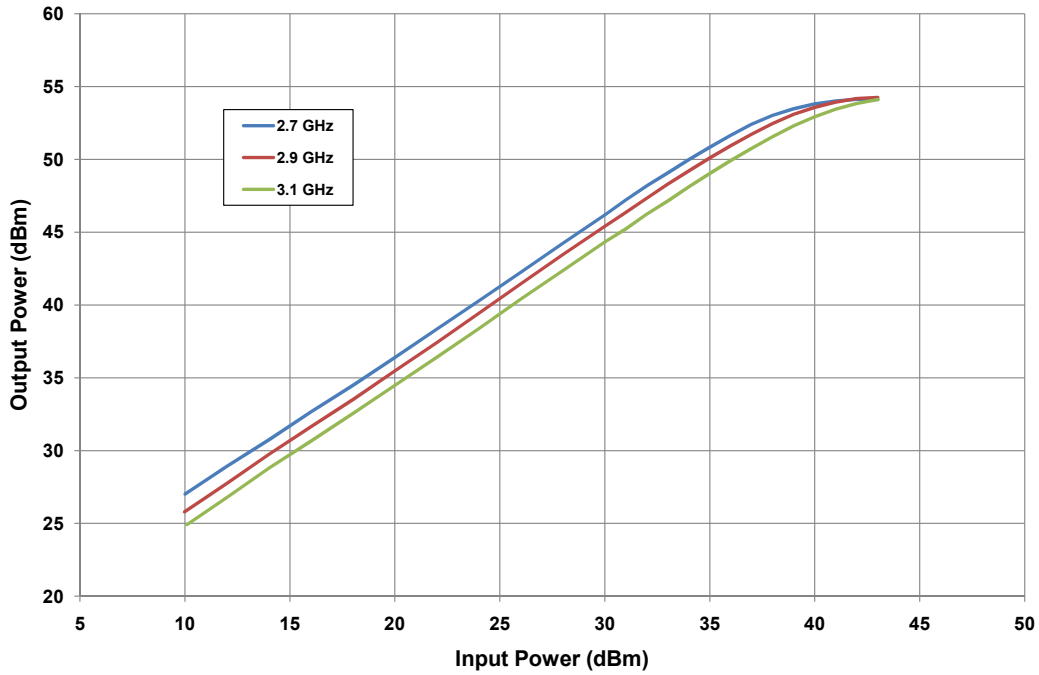
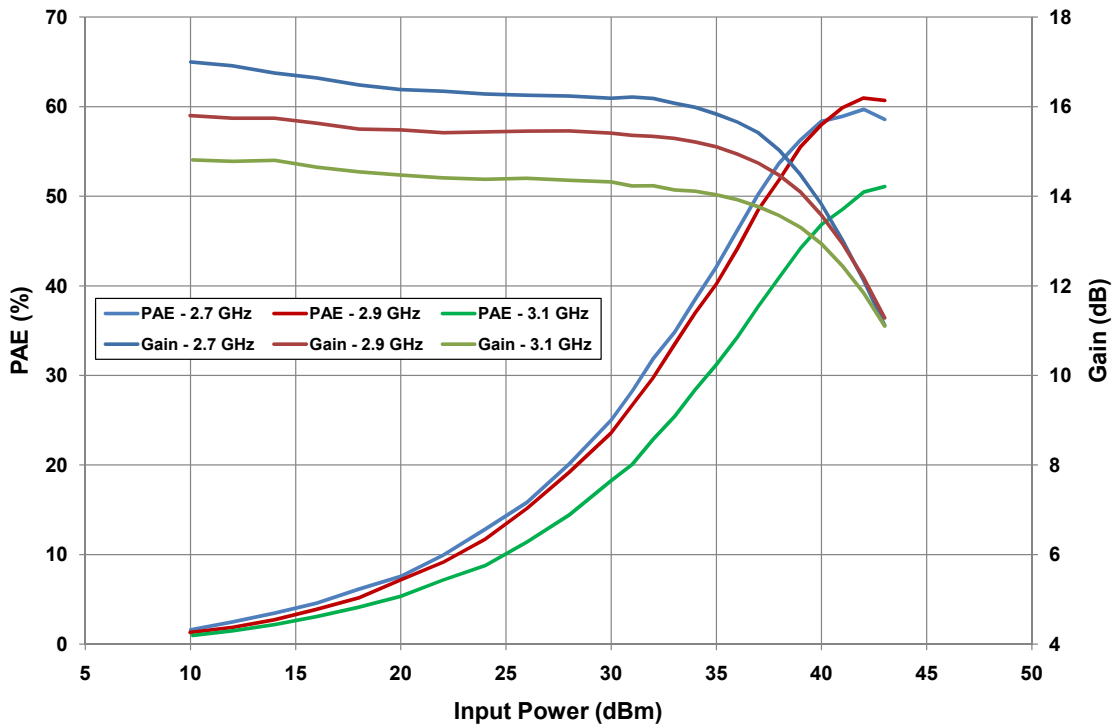


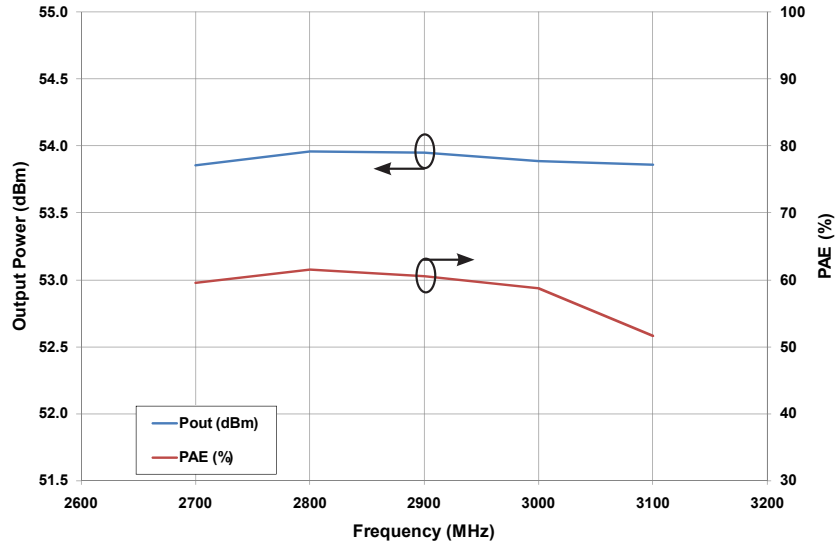
Figure 4.- CGH31240 PAE & Gain vs Input Power
 $V_{DS} = 28\text{ V}$, $I_{DS} = 1\text{ A}$, Pulse Width = $300\text{ }\mu\text{S}$, Duty Cycle = 20 %



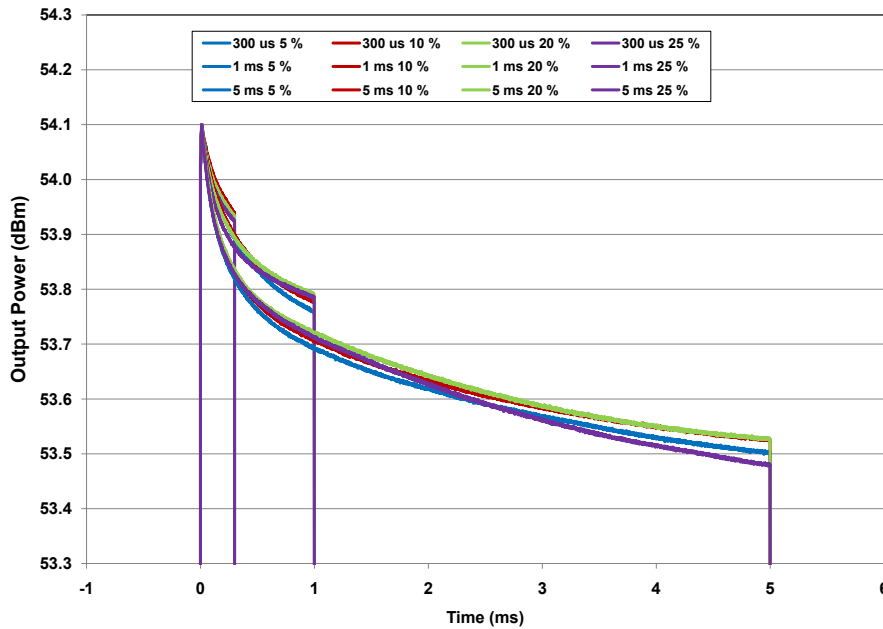
Typical Performance

Figure 5.- Typical Pulsed Output Power and Power Added Efficiency vs Frequency of the CGH31240F Measured in CGH31240-AMP1 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

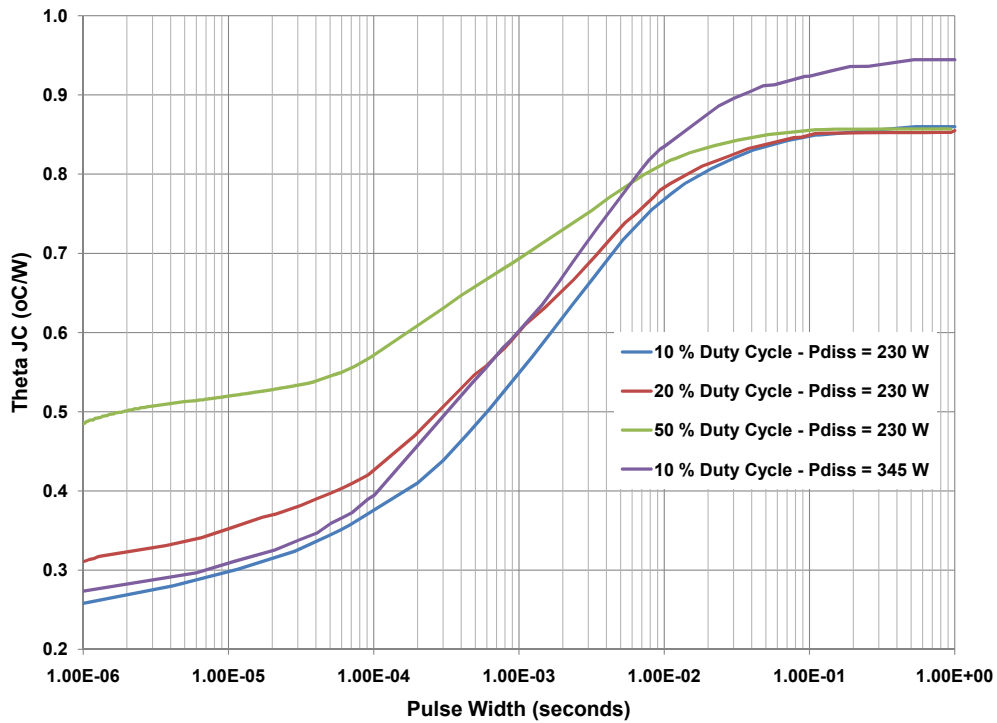


Pulse Width	Duty Cycle (%)	Droop (dB)
10 us	5-25	0.05
50 us	5-25	0.05
100 us	5-25	0.10
300 us	5-25	0.15
1 ms	5-25	0.30
5 ms	5-25	0.60

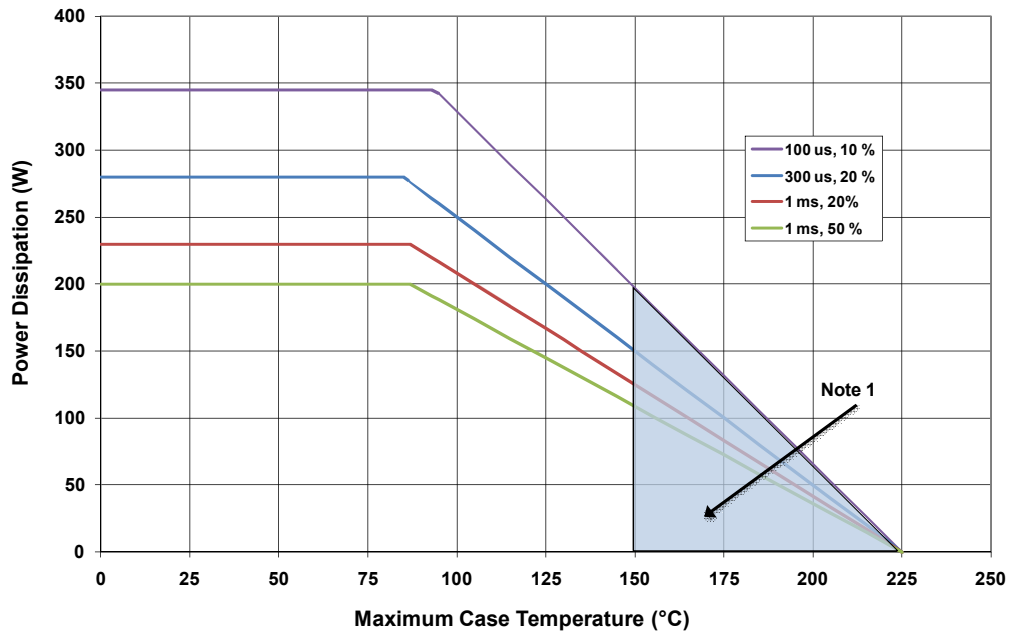
Electrostatic Discharge (ESD) Classifications

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

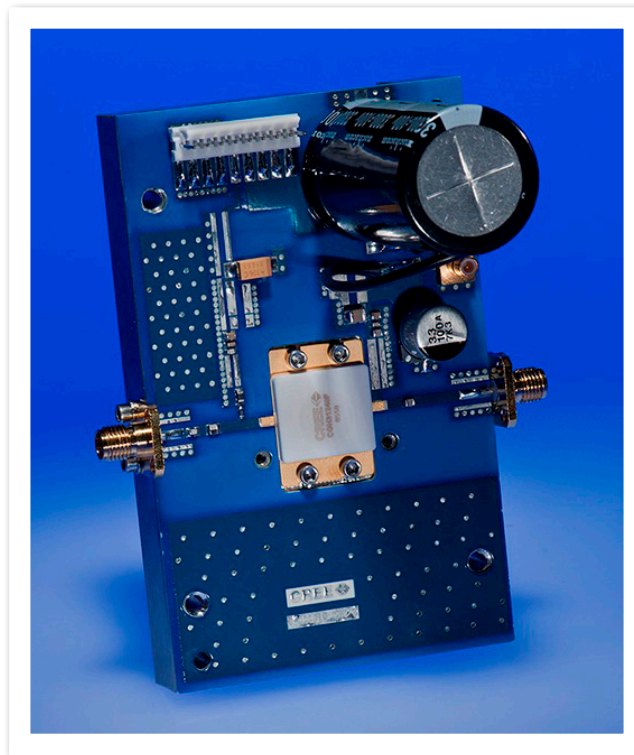


Note 1. Area exceeds Maximum Case Operating Temperature (See Page 2).

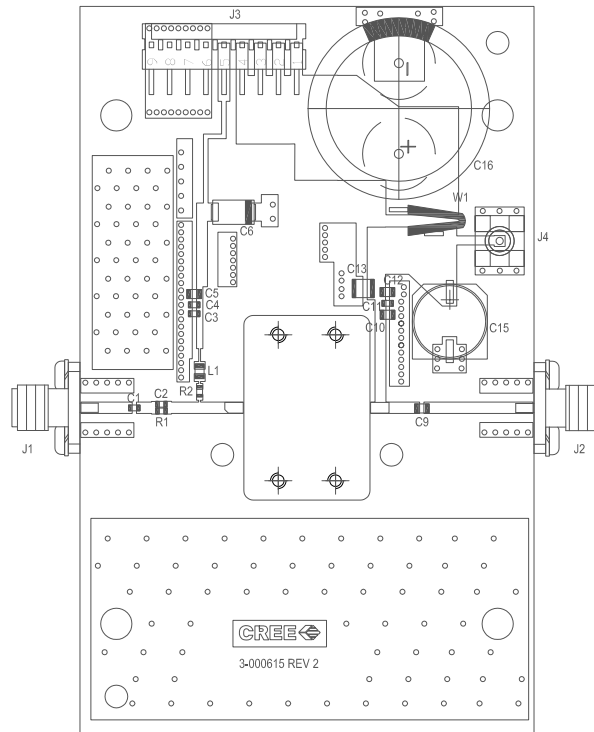
CGH31240F-AMP1 Demonstration Amplifier Circuit Bill of Materials

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

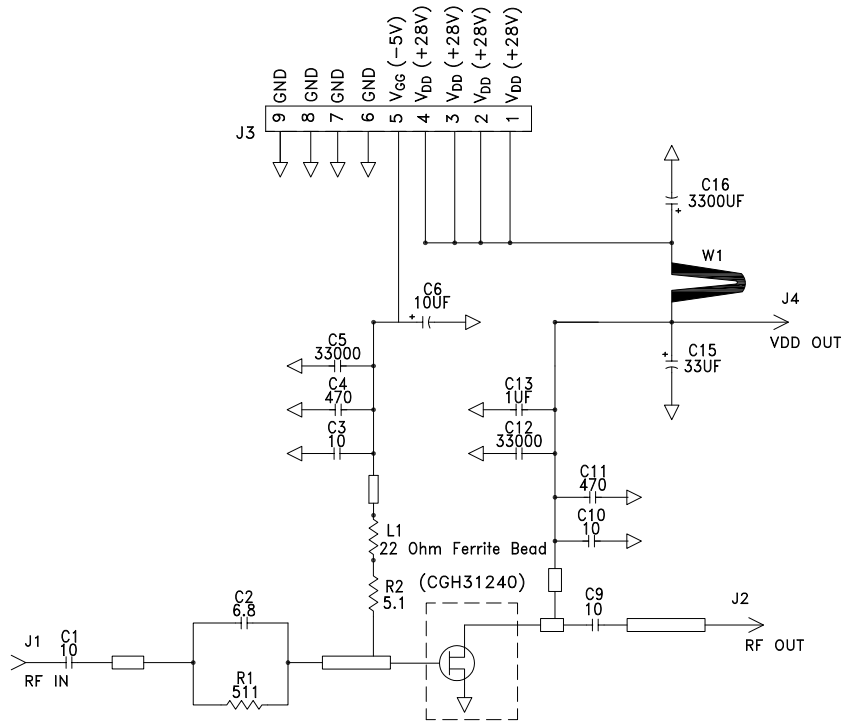
CGH31240F-AMP1 Demonstration Amplifier Circuit



CGH31240F-AMP1 Demonstration Amplifier Circuit Outline



CGH31240F-AMP1 Demonstration Amplifier Circuit Schematic

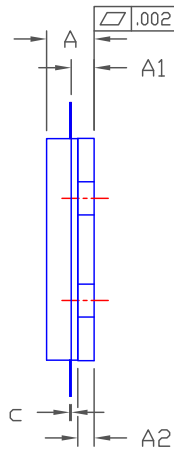
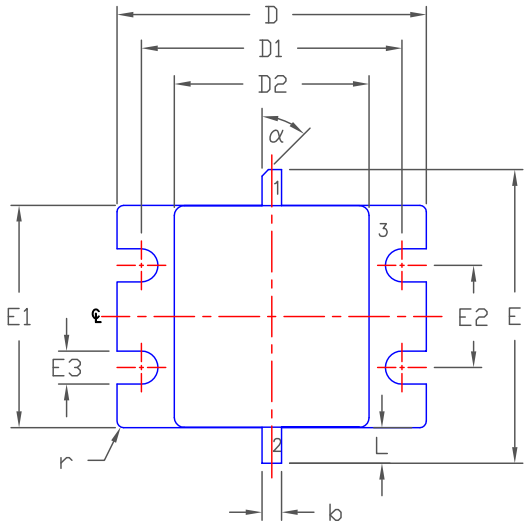


Typical Package S-Parameters for CGH31240F
 (Small Signal, $V_{DS} = 28\text{ V}$, $I_{DQ} = 1000\text{ mA}$, angle in degrees)

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)



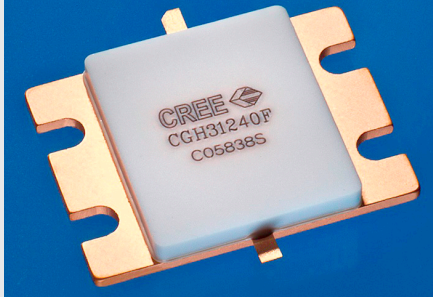
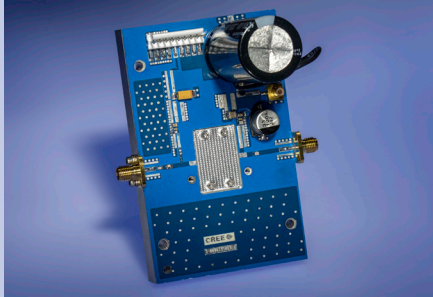
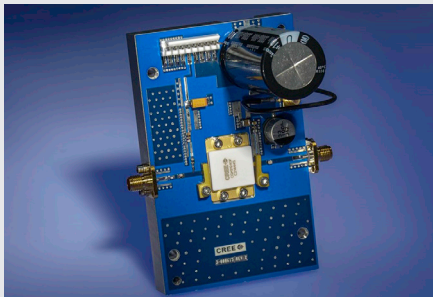
- PIN 1. GATE
 2. DRAIN
 3. SOURCE

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-AMP1	Test board with GaN HEMT installed	Each	



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