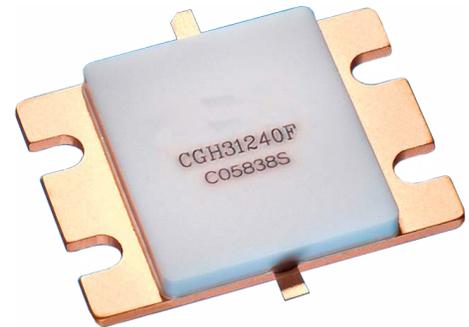


# CGH31240F

240 W, 2.7-3.1 GHz, 50-ohm Input/Output Matched, GaN HEMT for S-Band Radar Systems



## Description

The 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 2.7-3.1 GHz S-Band radar amplifier applications. The transistor is supplied in a ceramic/metal flange package.

Package Types: 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 $\mu\text{s}$  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	$V_{DS}$	120	V	25°C
Gate-to-Source Voltage	$V_{GS}$	-10, +2		
Power Dissipation	$P_{DISS}$	345	W	
Storage Temperature	$T_{STG}$	-65, +150	°C	
Operating Junction Temperature	$T_J$	225		
Maximum Forward Gate Current	$I_{GMAX}$	60	mA	25°C
Maximum Drain Current <sup>1</sup>	$I_{DMAX}$	24	A	
Soldering Temperature <sup>2</sup>	$T_S$	245	°C	
Screw Torque	$\tau$	40	in-oz	
Thermal Resistance, Junction to Case <sup>3</sup>	$R_{\theta JC}$	0.5	°C/W	85°C
Case Operating Temperature <sup>3</sup>	$T_C$	-40, +150	°C	30 seconds

Notes:

<sup>1</sup> Current limit for long term, reliable operation

<sup>2</sup> Refer to the Application Note on soldering

<sup>3</sup> Measured for the CGH31240F at  $P_{DISS} = 280$  W. Pulse Width = 300 $\mu$ s, Duty Cycle = 20%

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

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics<sup>1</sup></b>						
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	—		$V_{DS} = 28$ V, $I_D = 1.0$ mA
Saturated Drain Current <sup>2</sup>	$I_{DS}$	46.4	56.0	—	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	$V_{BR}$	84	—	—	$V_{DC}$	$V_{GS} = -8$ V, $I_D = 57.6$ mA
<b>RF Characteristics<sup>3</sup> (<math>T_C = 25^\circ\text{C}</math>, <math>F_0 = 2.7, 2.9, 3.1</math> GHz unless otherwise noted)</b>						
Output Power	$P_{OUT}$	200	250	—	W	$V_{DD} = 28$ V, $I_{DQ} = 1.0$ A, $P_{IN} = 42$ dBm
Power Added Efficiency at 2.7 GHz	PAE	49	54	—	%	
Power Added Efficiency at 2.9 GHz		52	58	—		
Power Added Efficiency at 3.1 GHz		42	49	—		
Power Gain	$G_p$	11	12	—	dB	$V_{DD} = 28$ V, $I_{DQ} = 1.0$ A, $P_{IN} = -10$ dBm
Small Signal Gain	S21	14	16	—		
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		
Pulse Amplitude Droop	D	—	0.15	—		

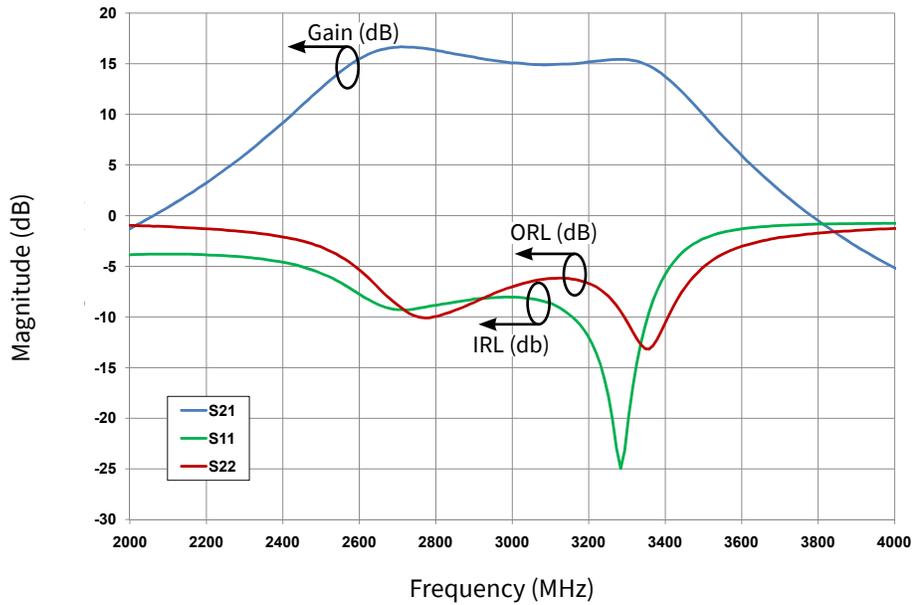
Notes:

<sup>1</sup> Measured on wafer prior to packaging

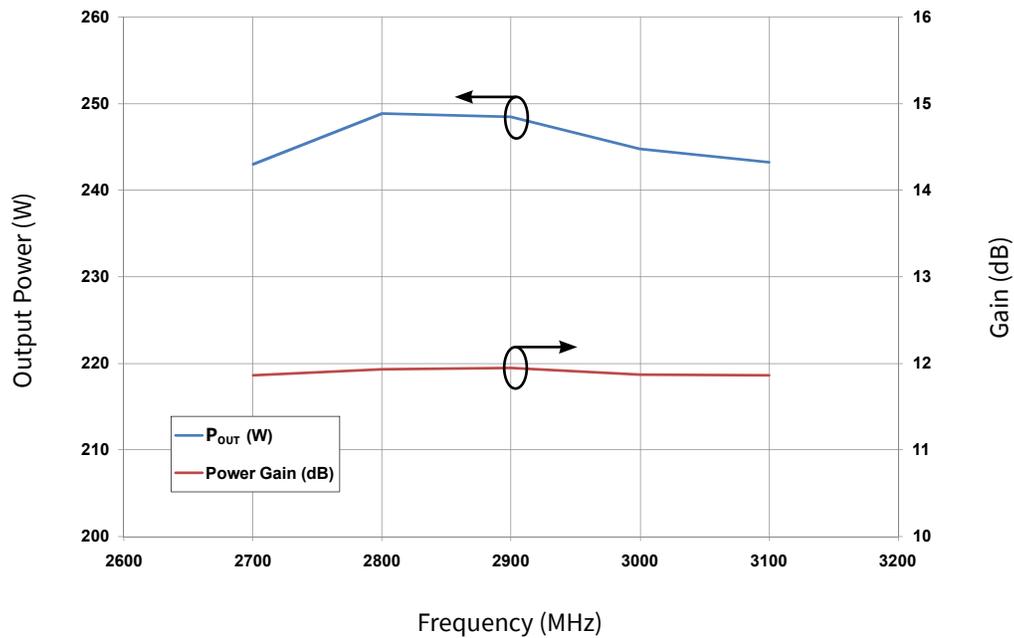
<sup>2</sup> Scaled from PCM data

<sup>3</sup> Measured in CGH31240F-AMP. Pulse Width = 300 $\mu$ s, Duty Cycle = 20%.

Typical Performance

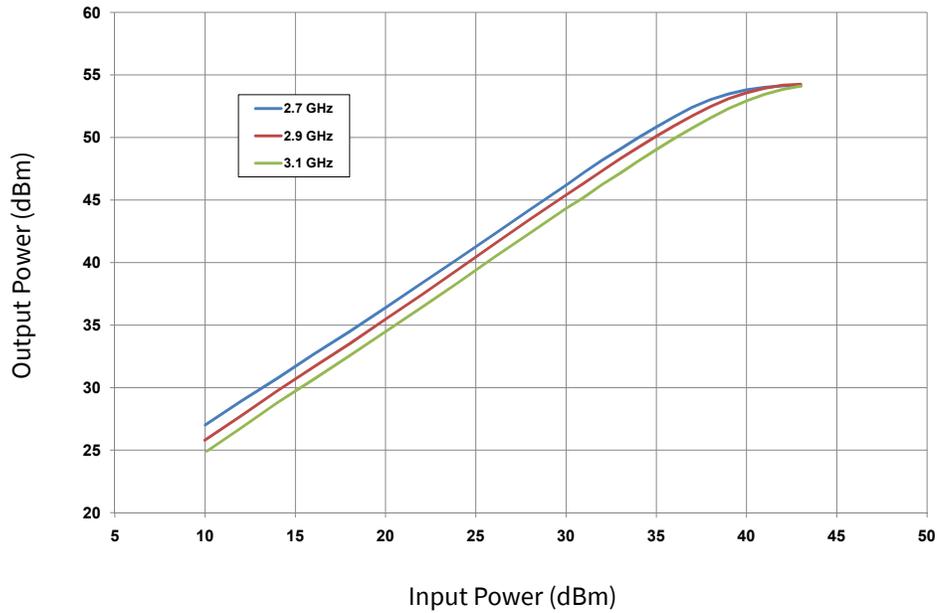


**Figure 1.** Gain and Return Losses vs Frequency of the CGH31240F Measured in CGH31240F-AMP Amplifier Circuit  
 $V_{DS} = 28\text{ V}$ ,  $I_{DS} = 1\text{ A}$

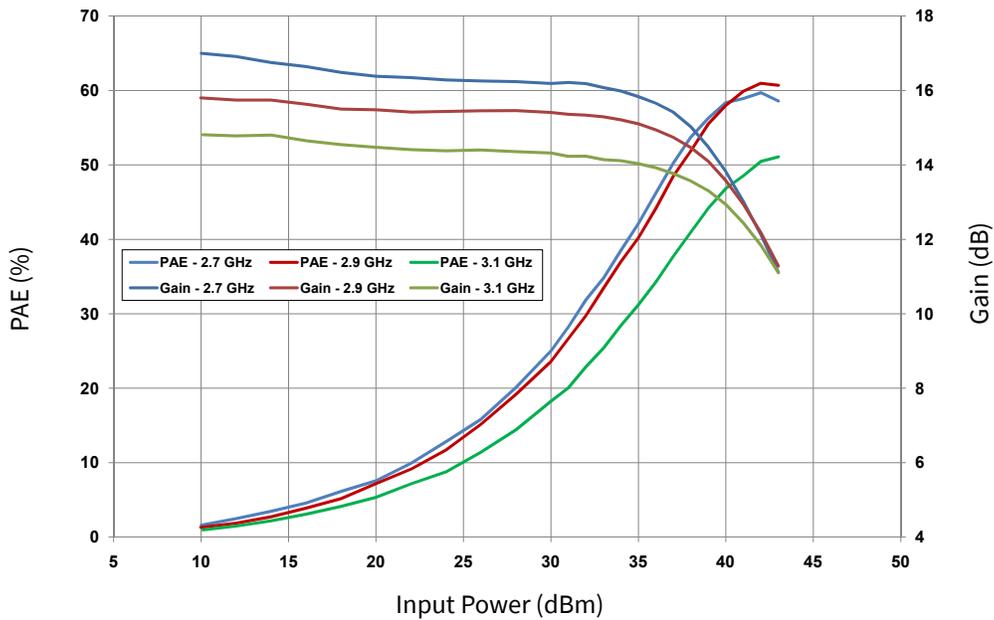


**Figure 2.** Typical Pulsed Output Power and Power Gain vs Frequency of the CGH31240F Measured in CGH31240F-AMP Amplifier Circuit  
 $V_{DS} = 28\text{ V}$ ,  $I_{DS} = 1\text{ A}$ ,  $P_{IN} = 42\text{ dBm}$ , Pulse Width =  $300\mu\text{s}$ , Duty Cycle = 20%

Typical Performance

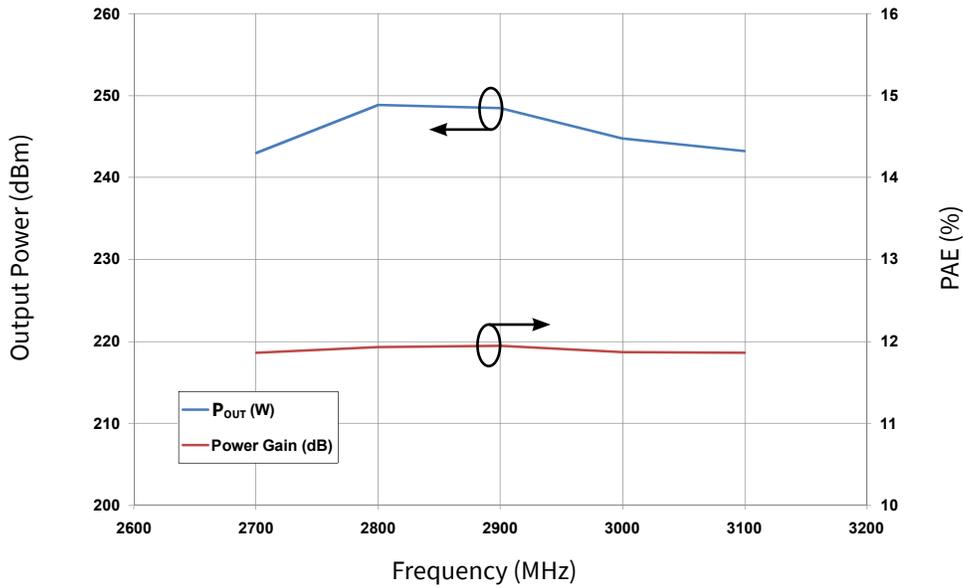


**Figure 3.** CGH31240F Output Power vs Input Power  
 $V_{DS} = 28\text{ V}$ ,  $I_{DS} = 1\text{ A}$ , Pulse Width =  $300\mu\text{s}$ , Duty Cycle = 20%



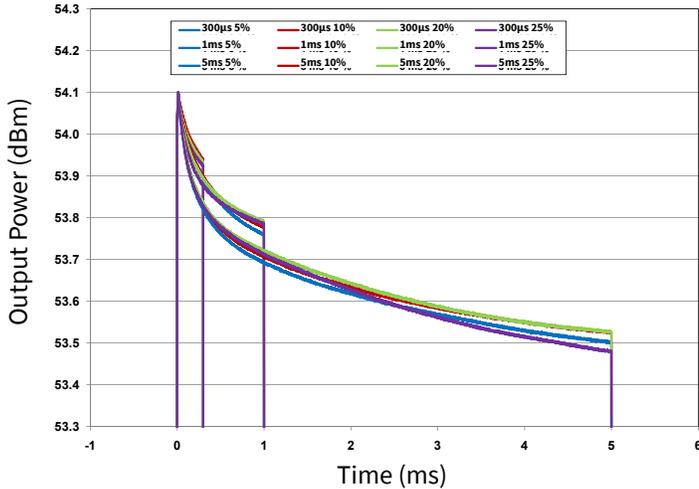
**Figure 4.** CGH31240F PAE & Gain vs Input Power  
 $V_{DS} = 28\text{ V}$ ,  $I_{DS} = 1\text{ A}$ , Pulse Width =  $300\mu\text{s}$ , Duty Cycle = 20%

### Typical Performance



**Figure 5.** Typical Pulsed Output Power and Power Added Efficiency vs Frequency of the CGH31240F Measured in CGH31240F-AMP Amplifier Circuit  $V_{DS} = 28\text{ V}$ ,  $I_{DS} = 1\text{ A}$ ,  $P_{IN} = 42\text{ dBm}$ , Pulse Width =  $300\mu\text{s}$ , Duty Cycle = 20%

### Typical Pulse Droop Performance

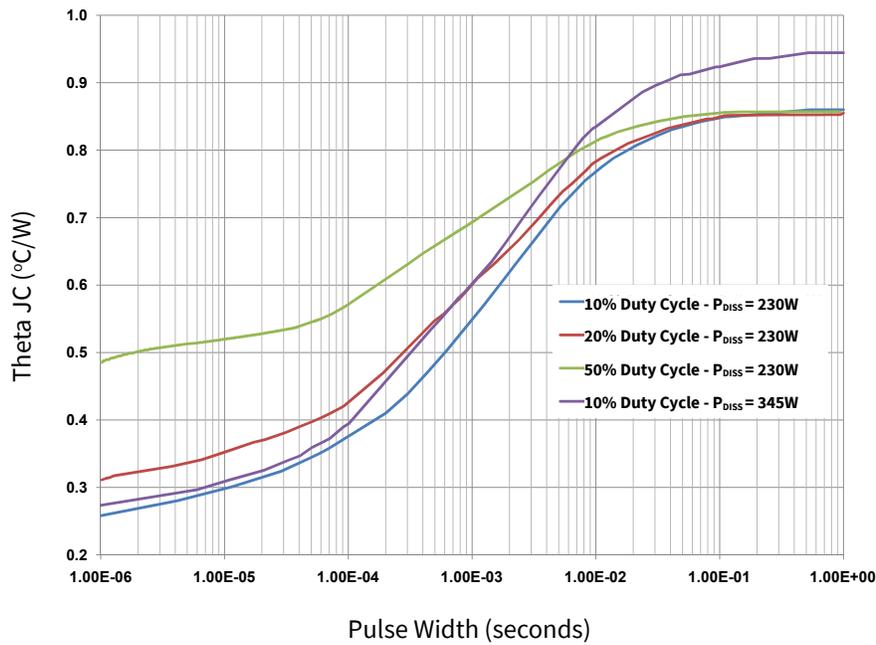


Pulse Width	Duty Cycle (%)	Droop (dB)
10µs	5-25	0.05
50µs	5-25	0.05
100µs	5-25	0.10
300µs	5-25	0.15
1ms	5-25	0.30
5ms	5-25	0.60

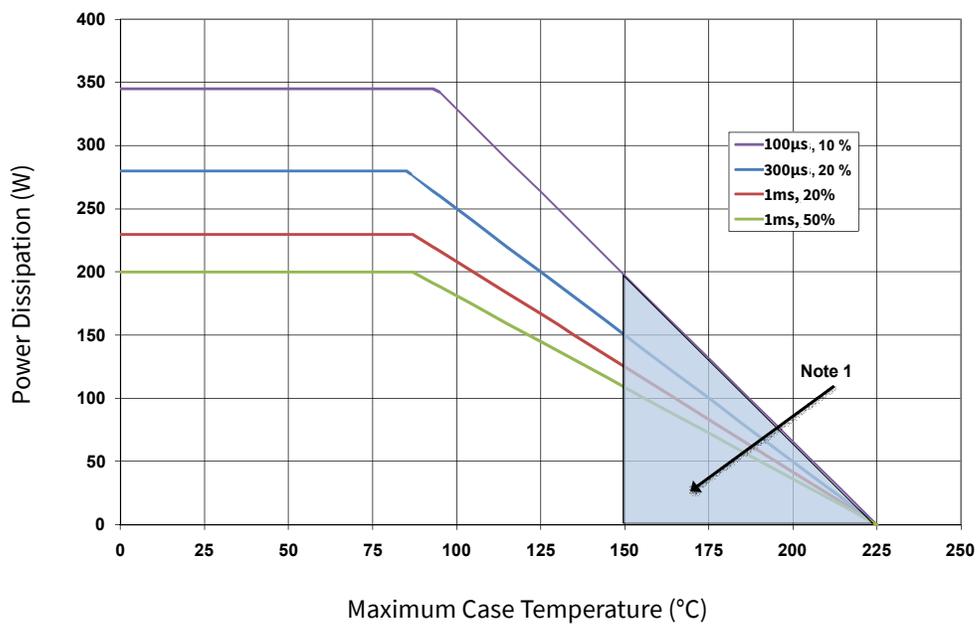
### Electrostatic Discharge (ESD) Classifications

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

### CGH31240F Pulse Transient Rth



### CGH31240F Transient Power Dissipation De-rating Curve

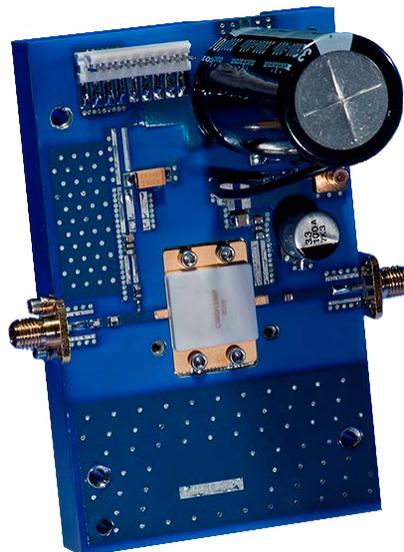


Note  
<sup>1</sup> Area exceeds Maximum Case Operating Temperature (See Page 2).

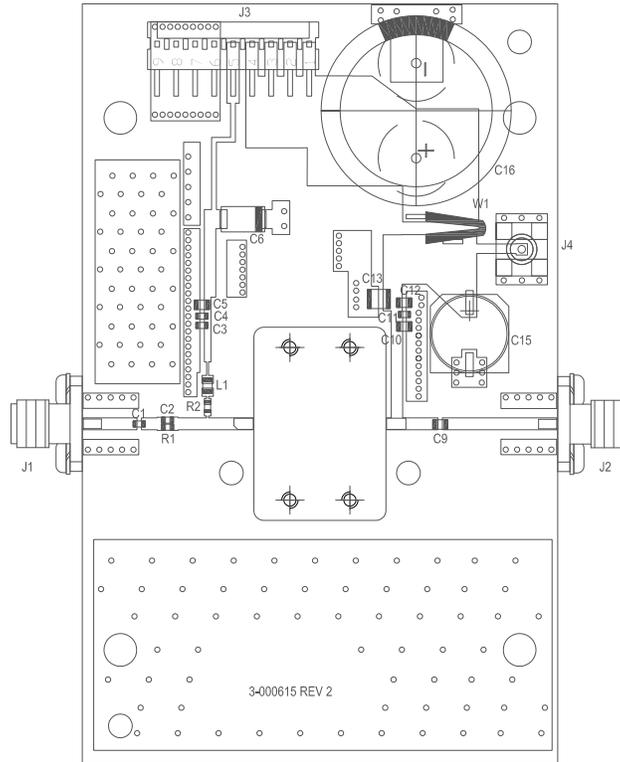
## CGH31240F-AMP Demonstration Amplifier Circuit Bill of Materials

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, +/- 0.25pF, 250V, 0603, ATC600S	1
C4, C11	CAP, 470pF, +/-5%, 100V, 0603, X7R	2
C15	CAP, 33μF, 20%, G CASE	1
C5, C12	CAP, 33000pF, 0805, 100V, X7R	2
C13	CAP, 1.0μF, 100V, 10%, X7R, 1210	1
C6	CAP, 10μF, 16V, TANTALUM	1
C9, C10	CAP, 10pF, +/- 1%, 250V, 0805	2
C16	CAP, 3300μF, +/-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

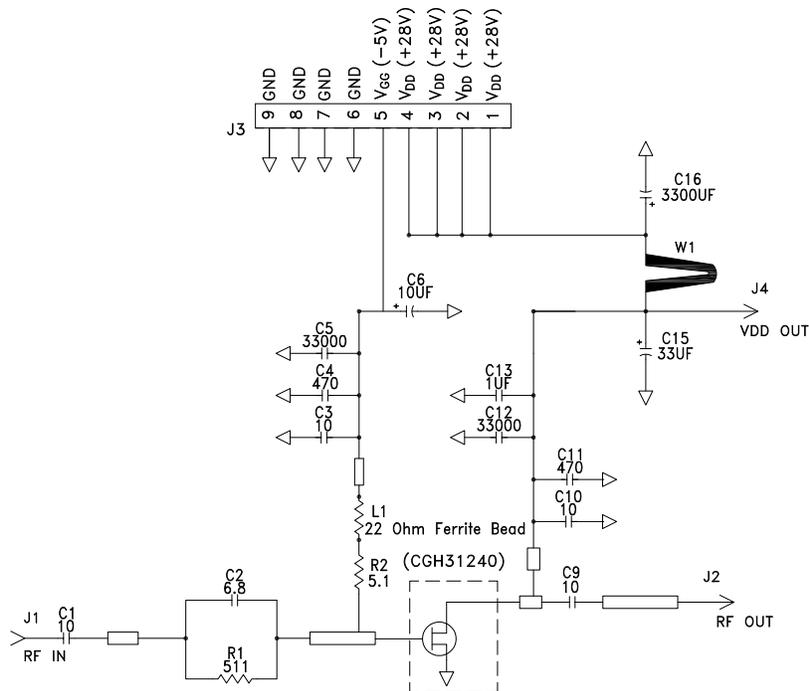
## CGH31240F-AMP Demonstration Amplifier Circuit



### CGH31240F-AMP Demonstration Amplifier Circuit Outline



### CGH31240F-AMP Demonstration Amplifier Circuit Schematic

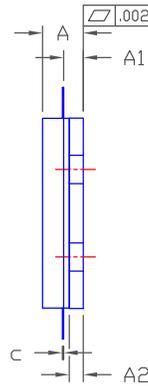
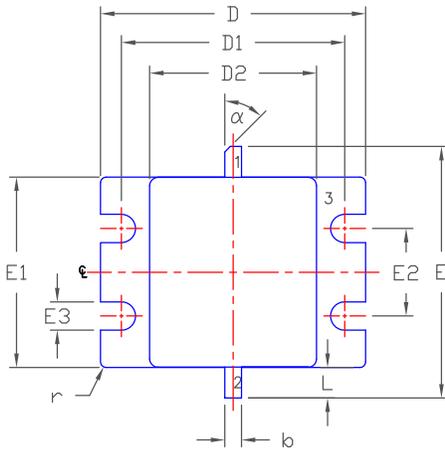


**Typical Package S-Parameters for CGH31240F**  
**(Small Signal,  $V_{DS} = 28$  V,  $I_{DQ} = 1000$  mA, angle in degrees)**

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.

**Product Dimensions CGH31240F (Package Type — 440201)**



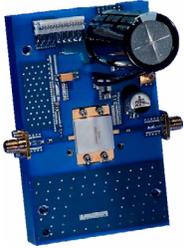
NOTES:

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	

- PIN 1. GATE  
 2. DRAIN  
 3. SOURCE

## Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGH31240F	GaN HEMT	Each	
CGH31240F-AMP	Test board with GaN HEMT installed	Each	

## Notes & Disclaimer

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