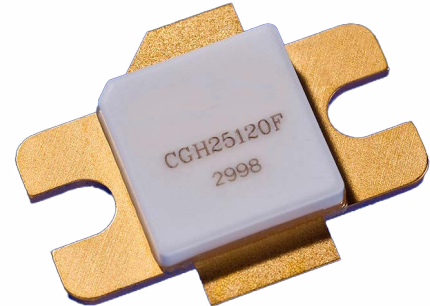


CGH25120F

120 W, 2.3-2.7 GHz, GaN HEMT
for WiMAX and LTE

Description

The CGH25120F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically for high efficiency, high gain and wide bandwidth capabilities, which makes the CGH25120F ideal for 2.3-2.7GHz WiMAX, LTE and BWA amplifier applications. The transistor is supplied in a ceramic/metal flange package.



Package Type: 440162
PN: CGH25120F

Typical Performance Over 2.3-2.7GHz ($T_c = 25^\circ\text{C}$) of Demonstration Amplifier

Parameter	2.3 GHz	2.4 GHz	2.5 GHz	2.6 GHz	2.7 GHz	Unit
Gain @ 43 dBm	12.5	12.8	13.1	13.5	13.6	dB
ACLR @ 43 dBm	-32.7	-34.0	-32.5	-29.5	-25.8	dBc
Drain Efficiency @ 43 dBm	26.5	28.0	30.0	32.5	34.5	%

Notes:

¹ Measured in the CGH25120F-AMP amplifier circuit, under equivalent 802.16e WiMAX signal, 10 MHz Bandwidth, PAR = 9.6 dB @ 0.01 % Probability on CCDF.

Features

- 2.3 - 2.7 GHz Operation
- 13 dB Gain
- -32 dBc ACLR at 20 W P_{AVE}
- 30% Efficiency at 20 W P_{AVE}
- High Degree of DPD Correction Can be Applied

 Large Signal Models Available for ADS and MWO



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

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DS}	120	V	25°C
Gate-to-Source Voltage	V_{GS}	-10, +2		
Power Dissipation	P_{DISS}	56	W	
Storage Temperature	T_{STG}	-65, +150	°C	
Operating Junction Temperature	T_J	225		
Maximum Forward Gate Current	I_{GMAX}	30	mA	25°C
Maximum Drain Current ¹	I_{DMAX}	12	A	
Soldering Temperature ²	T_S	245	°C	
Screw Torque	τ	40	in-oz	
Thermal Resistance, Junction to Case ³	$R_{\theta JC}$	1.5	°C/W	85°C
Case Operating Temperature ³	T_C	-40, +150	°C	

Notes:

¹ Current limit for long term, reliable operation

² Refer to the Application Note on soldering

³ Measured for the CGH25120F at $P_{DISS} = 56$ W

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, $I_D = 28.8$ mA
Gate Quiescent Voltage	$V_{GS(Q)}$	—	-2.7	—		$V_{DS} = 28$ V, $I_D = 0.5$ A
Saturated Drain Current ²	I_{DS}	23.2	28.0	—	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	V_{BR}	84	—	—	V_{DC}	$V_{GS} = -8$ V, $I_D = 28.8$ mA
RF Characteristics ($T_C = 25^\circ\text{C}$, $F_0 = 2.5$ GHz unless otherwise noted)						
Saturated Output Power ^{3,4,5}	P_{SAT}	—	130	—	W	$V_{DD} = 28$ V, $I_{DQ} = 0.5$ A
Pulsed Drain Efficiency ^{3,5}	η	—	60	—	%	$V_{DD} = 28$ V, $I_{DQ} = 0.5$ A, $P_{OUT} = P_{SAT}$
Modulated Gain ⁶	G	10.5	12.5	—	dB	$V_{DD} = 28$ V, $I_{DQ} = 0.5$ A, $P_{OUT} = 43$ dBm
WCDMA Linearity ^{6,7}	ACLR	—	-31	-27	dBc	
Modulated Drain Efficiency ⁶	η	27	32	—	%	
Output Mismatch Stress	VSWR	—	—	10 : 1	Ψ	No damage at all phase angles, $V_{DD} = 28$ V, $I_{DQ} = 1.0$ A, $P_{OUT} = 20$ W CW
Dynamic Characteristics						
Input Capacitance ⁸	C_{GS}	—	88	—	pF	$V_{DS} = 28$ V, $V_{GS} = -8$ V, $f = 1$ MHz
Output Capacitance ⁸	C_{DS}	—	12	—		
Feedback Capacitance	C_{GD}	—	1.6	—		

Notes:

¹ Measured on wafer prior to packaging

² Scaled from PCM data

³ Pulse Width = 40 μ s, Duty Cycle = 5%

⁴ P_{SAT} is defined as $I_G = 10$ mA peak

⁵ Measured in CGH25120F-AMP

⁶ Equivalent 802.16e WiMAX signal, 10 MHz Bandwidth, PAR = 9.6 dB @ 0.01% Probability on CCDF

⁷ Measured over 10 MHz bandwidth at 10 MHz offset from carrier edge.

⁸ Includes package and internal matching components.

Typical Performance

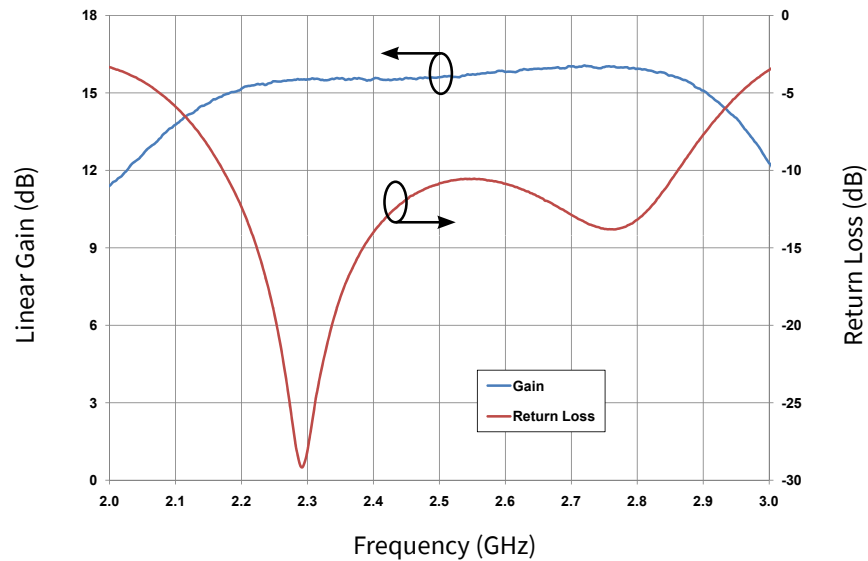


Figure 1. Gain and Input Return Loss vs Frequency of CGH25120F in Broadband Amplifier Circuit
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 0.5\text{ A}$

Typical Mobile WiMAX Digital Pre-Distortion (DPD) Performance

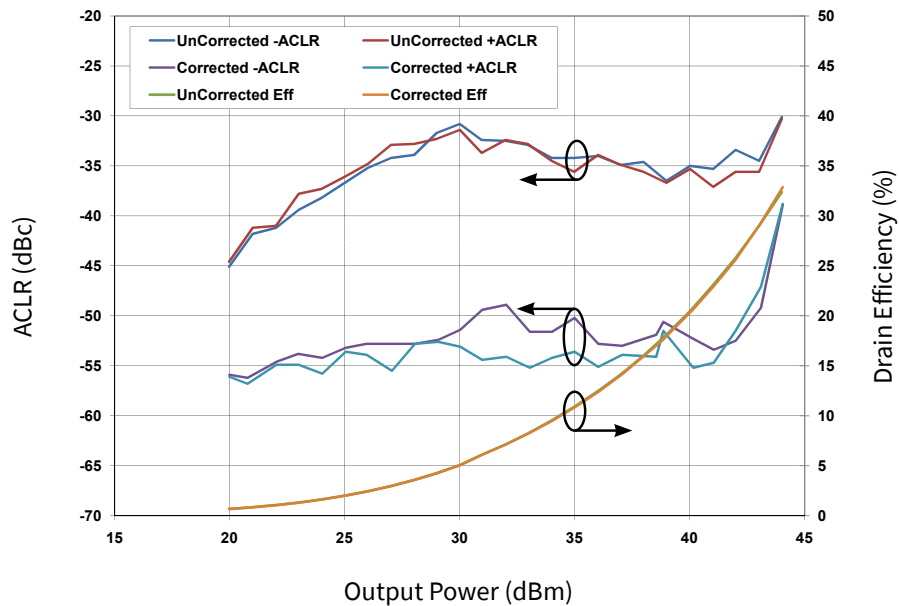


Figure 2. WiMAX Characteristics with and without DPD Correction ACLR and Drain Efficiency vs Output Power measured in CGH25120F-AMP Amplifier Circuit
 $V_{DS} = 28\text{ V}$, $I_{DS} = 0.5\text{ A}$, Frequency = 2.5 GHz

Typical Performance

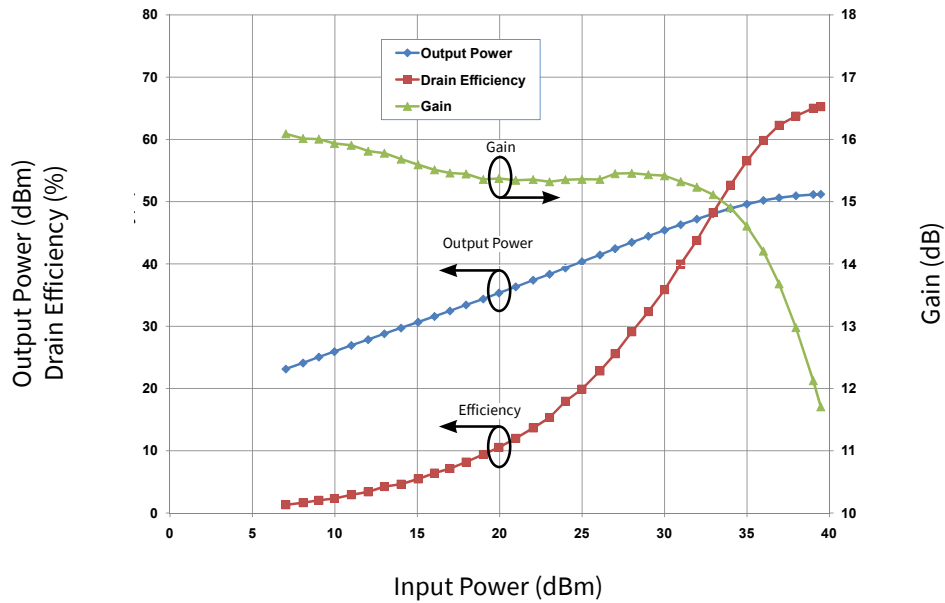


Figure 3. Typical Pulse Characteristics Output Power, Drain Efficiency, and Gain vs Input Power measured in CGH25120F-AMP Amplifier Circuit
 $V_{DD} = 28\text{ V}$, $I_{DS} = 0.5\text{ A}$, Freq = 2.5 GHz, Pulse Width = 40 μs , Duty Cycle = 5%

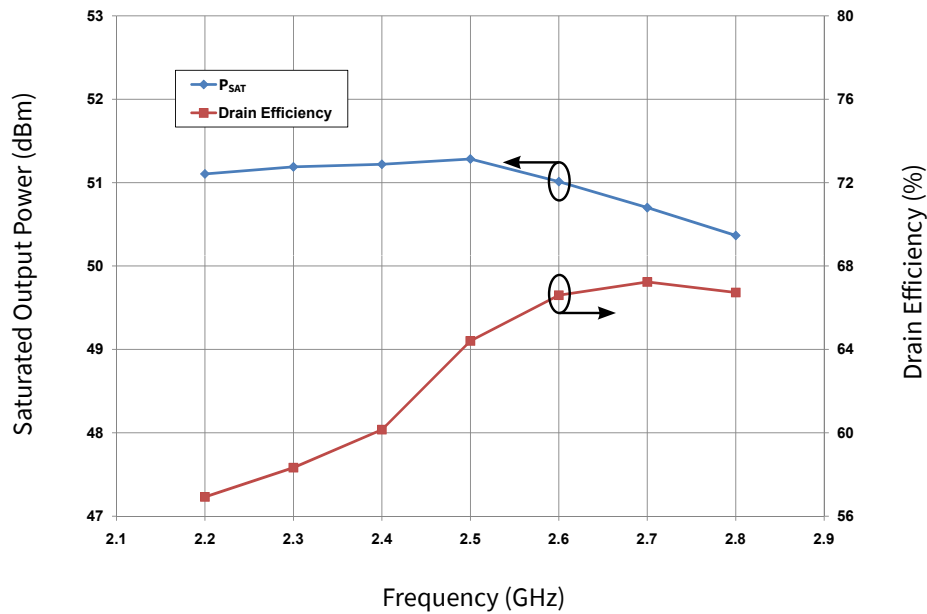


Figure 4. Typical Pulsed Saturated Power vs Frequency measured in CGH25120F-AMP Amplifier Circuit
 $V_{DS} = 28\text{ V}$, $I_{DS} = 0.5\text{ A}$, $P_{SAT} = 10\text{ mA}$ I_{GS} Peak, Pulse Width = 40 μs , Duty Cycle = 5%

Typical Performance

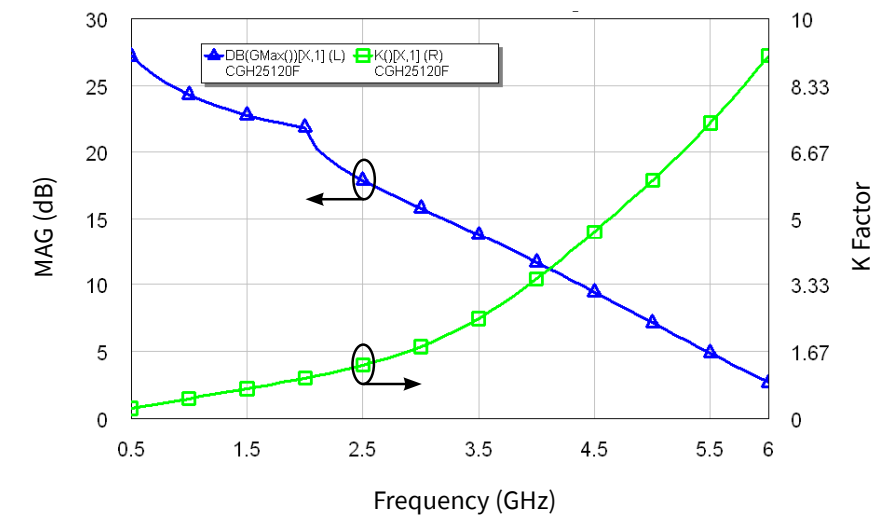


Figure 5. Simulated Maximum Available Gain and K Factor of the CGH25120F
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 500\text{ mA}$

Typical Noise Performance

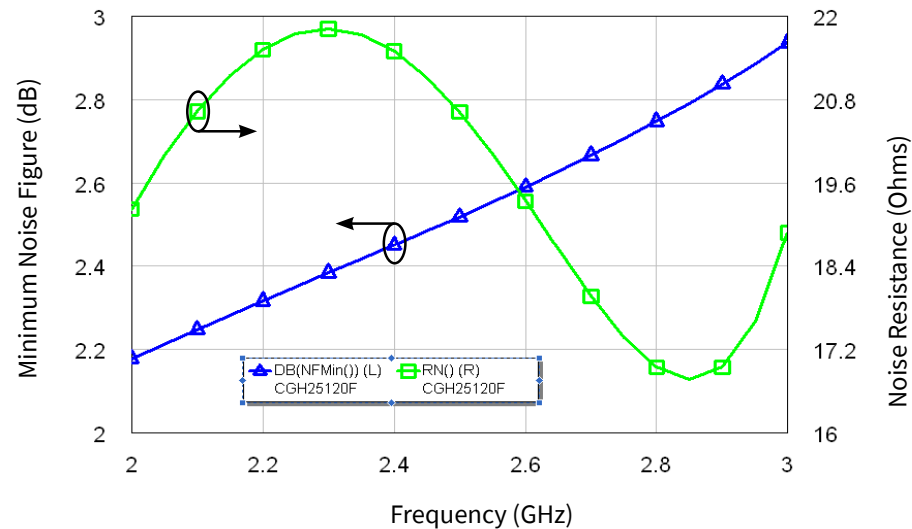
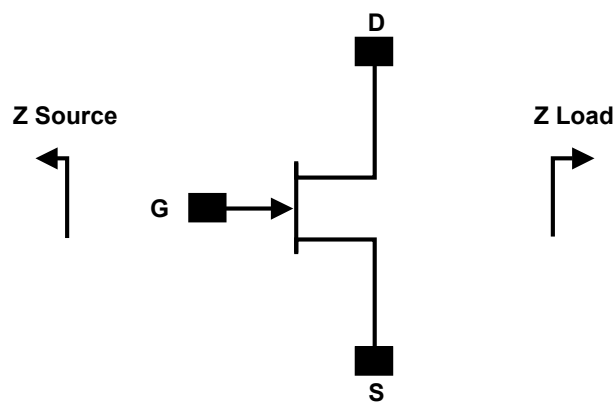


Figure 6. Simulated Minimum Noise Figure and Noise Resistance vs Frequency of the CGH25120F
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 500\text{ mA}$

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

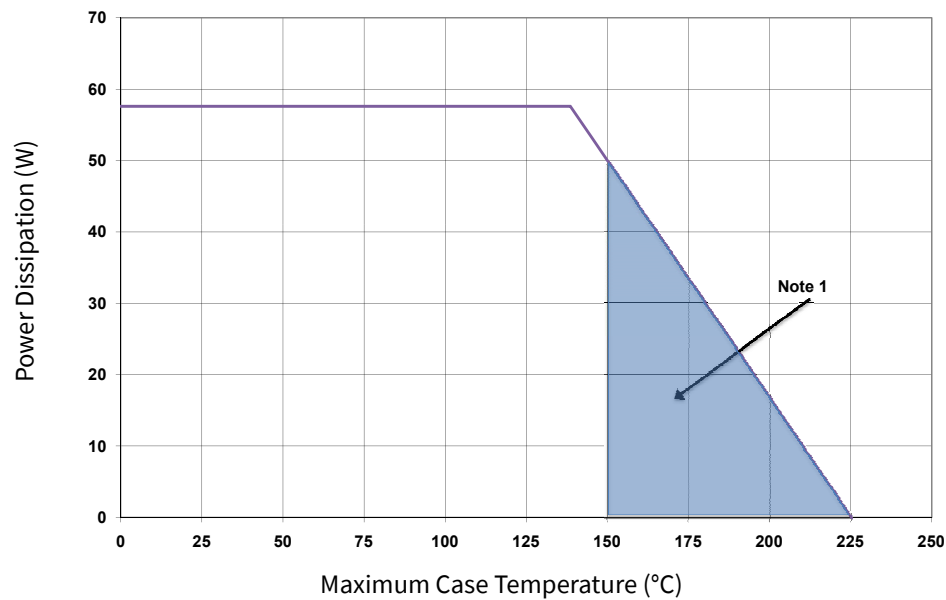
Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
2300	6.80 - j12.19	4.38 - j1.42
2350	6.42 - j11.89	4.39 - j1.36
2400	6.05 - j11.61	4.39 - j1.33
2450	15.71 - j11.34	4.36 - j1.32
2500	5.37 - j11.08	4.31 - j1.33
2550	5.04 - j10.83	4.23 - j1.34
2600	4.71 - j10.57	4.11 - j1.36
2650	4.39 - j10.31	3.98 - j1.37
2700	4.07 - j10.04	3.80 - j1.36

Notes:
¹ V_{DD} = 28 V, I_{bq} = 500mA. In the 440162 package
² Impedances are extracted from CGH25120F-AMP demonstration circuit and are not source and load pull data derived from transistor

CGH25120F Power Dissipation De-rating Curve

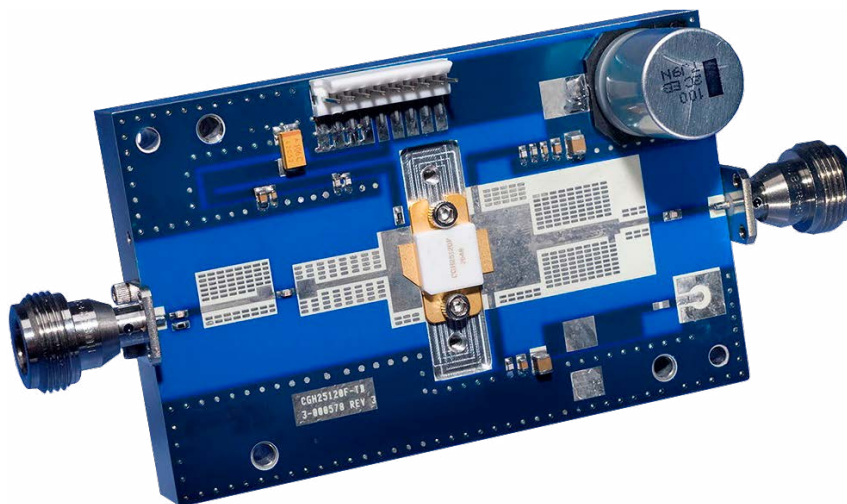


Note:
¹ Area exceeds Maximum Case Operating Temperature (See Page 2)

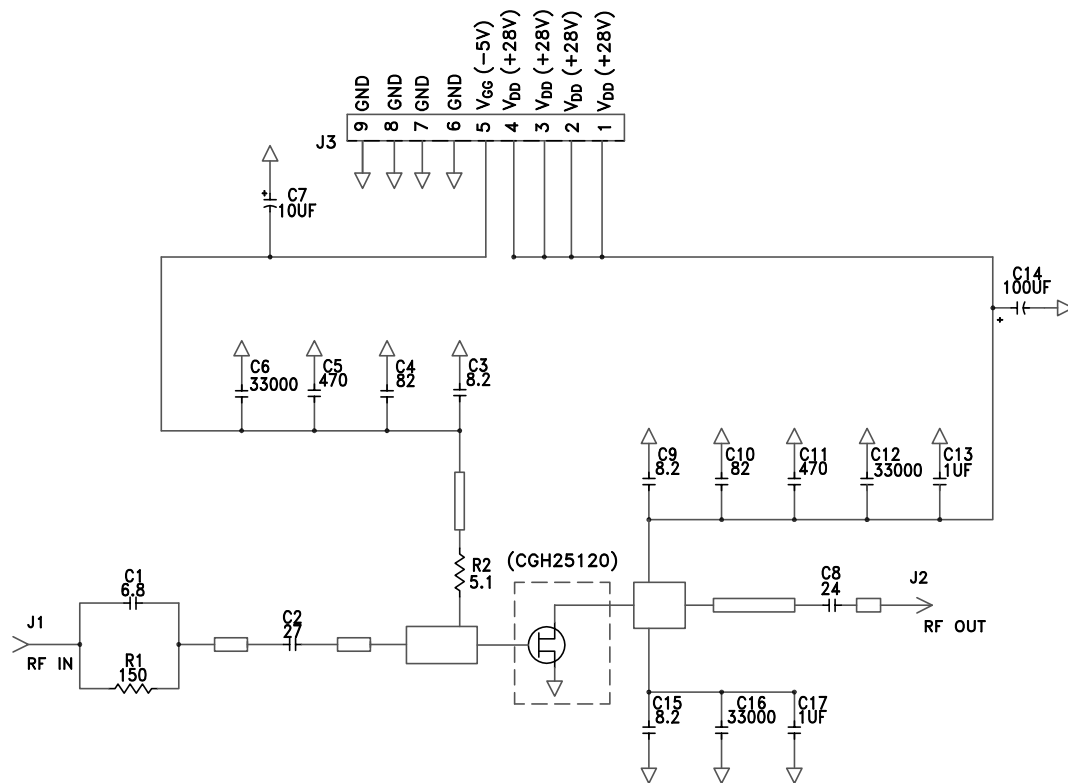
CGH25120F-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 1/16 W, 0603, 1%, 150 OHMS	1
R2	RES, 1/16 W, 0603, 1%, 5.1 OHMS	1
C1	CAP, 6.8pF, +/-0.25pF, 0603, ATC600S	1
C2	CAP, 27pF, +/-5%, 0603, ATC600S	1
C3, C9, C15	CAP, 8.2pF, +/-0.25pF, 0603, ATC600S	3
C4, C10	CAP, 82.0pF, +/-5%, 0603, ATC600S	2
C5, C11	CAP, 470pF, 5%, 100V, 0603, X7R	2
C6, C12, C16	CAP, 33000pF, 0805, 100V, X7R	3
C7	CAP, 10μF, 16V, TANTALUM	1
C8	CAP, 24pF, +/-5%, 0603, ATC600S	1
C13, C17	CAP, 1.0μF, 100V, 10%, X7R, 1210	2
C14	CAP, 100μF, +/-20%, 160V, ELECTROLYTIC	1
J1, J2	CONN, N-Type, Female, 0.500 SMA Flange	2
J3	CONN, Header, RT> PLZ, 0.1 CEN, LK, 9 POS	1
—	PCB, RO4350, Er = 3.48, h = 20 mil	1
—	CGH25120F	1

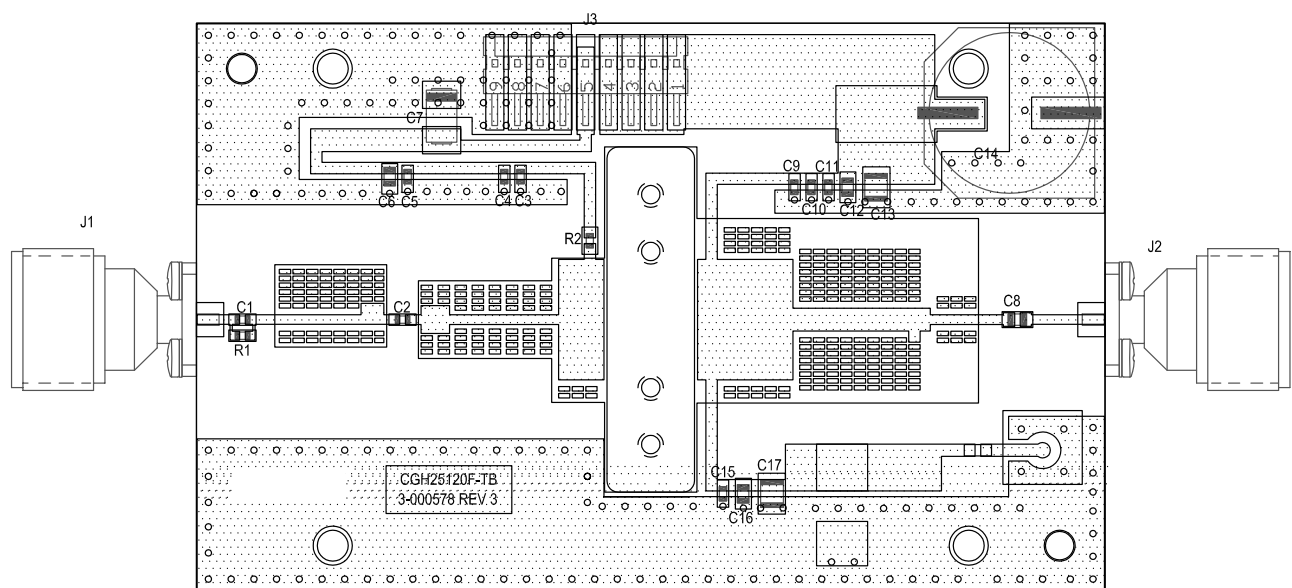
CGH25120F-AMP Demonstration Amplifier Circuit



CGH25120F-AMP Demonstration Amplifier Circuit Schematic



CGH25120F-AMP Demonstration Amplifier Circuit Outline

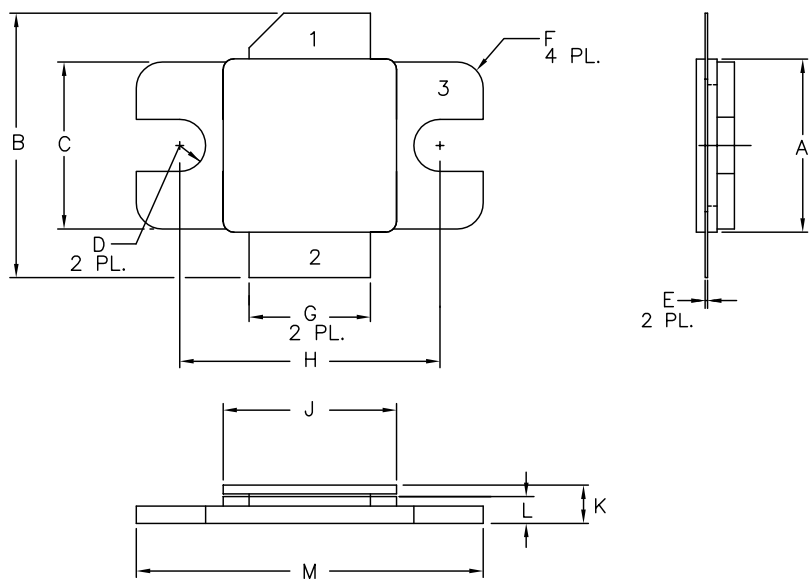


Typical Package S-Parameters for CGH25120
(Small Signal, $V_{DS} = 28\text{ V}$, $I_{DQ} = 500\text{ mA}$, angle in degrees)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.970	179.55	3.23	65.19	0.006	-19.55	0.697	-171.85
600 MHz	0.969	178.04	2.71	59.73	0.006	-23.92	0.712	-171.11
700 MHz	0.969	176.68	2.35	54.43	0.006	-28.13	0.728	-170.54
800 MHz	0.968	175.39	2.08	49.24	0.006	-32.20	0.744	-170.15
900 MHz	0.967	174.12	1.88	44.13	0.006	-36.17	0.760	-169.90
1.0 GHz	0.965	172.86	1.73	39.07	0.006	-40.07	0.776	-169.80
1.1 GHz	0.963	171.57	1.62	34.02	0.007	-43.93	0.792	-169.82
1.2 GHz	0.961	170.24	1.53	28.94	0.007	-47.79	0.808	-169.93
1.3 GHz	0.957	168.86	1.47	23.78	0.007	-51.71	0.823	-170.13
1.4 GHz	0.953	167.39	1.43	18.47	0.007	-55.72	0.838	-170.41
1.5 GHz	0.948	165.84	1.41	12.95	0.007	-59.92	0.853	-170.74
1.6 GHz	0.941	164.19	1.40	7.11	0.008	-64.38	0.868	-171.14
1.7 GHz	0.932	162.42	1.41	0.85	0.008	-69.21	0.882	-171.61
1.8 GHz	0.921	160.54	1.44	-5.98	0.009	-74.56	0.897	-172.16
1.9 GHz	0.906	158.55	1.49	-13.54	0.009	-80.57	0.912	-172.82
2.0 GHz	0.887	156.51	1.54	-22.02	0.010	-87.43	0.928	-173.62
2.1 GHz	0.863	154.51	1.61	-31.62	0.011	-95.34	0.943	-174.61
2.2 GHz	0.836	152.72	1.68	-42.48	0.012	-104.43	0.956	-175.83
2.3 GHz	0.807	151.32	1.73	-54.61	0.012	-114.71	0.966	-177.27
2.4 GHz	0.782	150.41	1.76	-67.78	0.013	-125.92	0.970	-178.85
2.5 GHz	0.767	149.70	1.74	-81.50	0.013	-137.58	0.968	-179.58
2.6 GHz	0.765	148.57	1.69	-95.15	0.013	-149.05	0.960	-178.22
2.7 GHz	0.772	146.34	1.61	-108.22	0.012	-159.82	0.948	-177.17
2.8 GHz	0.784	142.57	1.52	-120.49	0.012	-169.67	0.937	-176.41
2.9 GHz	0.795	137.00	1.43	-132.07	0.012	-178.68	0.926	-175.88
3.0 GHz	0.802	129.35	1.37	-143.26	0.011	-172.84	0.918	-175.48
3.2 GHz	0.800	105.38	1.29	-166.46	0.011	-155.52	0.907	-174.80
3.4 GHz	0.786	62.35	1.25	-164.88	0.011	-133.38	0.901	-174.02
3.6 GHz	0.824	-2.68	1.08	-128.15	0.010	-103.76	0.897	-172.96
3.8 GHz	0.913	-61.31	0.73	-93.46	0.007	-76.68	0.890	-171.72
4.0 GHz	0.963	-96.70	0.45	-69.63	0.005	-60.78	0.881	-170.41
4.2 GHz	0.983	-116.99	0.29	-53.87	0.003	-53.02	0.872	-168.93
4.4 GHz	0.992	-129.53	0.19	-42.45	0.002	-49.41	0.860	-167.19
4.6 GHz	0.995	-137.94	0.14	-33.27	0.002	-47.62	0.844	-165.11
4.8 GHz	0.997	-143.97	0.10	-25.19	0.002	-46.36	0.823	-162.61
5.0 GHz	0.998	-148.50	0.08	-17.50	0.001	-44.82	0.793	-159.54
5.2 GHz	0.999	-152.04	0.07	-9.61	0.001	-42.41	0.751	-155.74
5.4 GHz	0.999	-154.90	0.06	-0.93	0.001	-38.57	0.688	-150.96
5.6 GHz	0.999	-157.26	0.05	-9.20	0.001	-32.67	0.594	-145.02
5.8 GHz	0.999	-159.26	0.04	-21.62	0.001	-23.98	0.453	-138.33
6.0 GHz	1.000	-160.97	0.04	-36.99	0.001	-11.87	0.251	-136.18

To download the s-parameters in s2p format, go to the CGH25120F Product page.

Product Dimensions CGH25120F (Package Type — 440162)


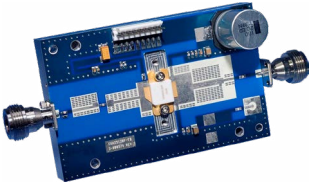


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
 4. LID MAY BE MISALIGNED TO THE BODY OF THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.395	.405	10.03	10.29
B	.580	.620	14.73	15.75
C	.380	.390	9.65	9.91
D	.055	.065	1.40	1.65
E	.004	.006	0.10	0.15
F	.055	.065	1.40	1.65
G	.275	.285	6.99	7.24
H	.595	.605	15.11	15.37
J	.395	.405	10.03	10.29
K	.129	.149	3.28	3.78
L	.053	.067	1.35	1.70
M	.795	.805	20.19	20.45

- PIN 1. GATE
 PIN 2. DRAIN
 PIN 3. SOURCE

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGH25120F	GaN HEMT	Each	
CGH25120F-AMP	Test board with GaN HEMT installed	Each	

Notes & Disclaimer

MACOM Technology Solutions Inc. ("MACOM"). All rights reserved.

These materials are provided in connection with MACOM's products as a service to its customers and may be used for informational purposes only. Except as provided in its Terms and Conditions of Sale or any separate agreement, MACOM assumes no liability or responsibility whatsoever, including for (i) errors or omissions in these materials; (ii) failure to update these materials; or (iii) conflicts or incompatibilities arising from future changes to specifications and product descriptions, which MACOM may make at any time, without notice. These materials grant no license, express or implied, to any intellectual property rights.

THESE MATERIALS ARE PROVIDED "AS IS" WITH NO WARRANTY OR LIABILITY, EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHT, ACCURACY OR COMPLETENESS, OR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.