CGH35030F

30 W, 3.3-3.9 GHz, 28V, GaN HEMT for WiMAX

Package Types: 440166
PN: CGH35030F

Description

Wolfspeed's CGH35030F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically for high efficiency, high gain and wide bandwidth capabilities, which makes the CGH35030F ideal for 3.3-3.9 GHz WiMAX and BWA amplifier applications. The transistor is supplied in a ceramic/metal flange package.

Typical Performance Over 3.3-3.8 GHz (T_C = 25°C) of Demonstration Amplifier

Parameter	3.3 GHz	3.4 GHz	3.5 GHz	3.6 GHz	3.7 GHz	3.8 GHz	Units
Small Signal Gain	11.6	11.8	11.8	12.0	12.4	13.0	dB
EVM at P_{AVE} = 23 dBm	2.42	2.26	2.09	2.11	2.13	2.38	%
EVM at P_{AVE} = 36 dBm	1.97	1.74	1.68	1.79	2.01	2.37	%
Drain Efficiency @ 36 dBm	20.8	21.9	23.5	25.4	27.4	29.1	%
Input Return Loss	12.3	8.5	6.1	5.4	6.1	9.0	dB

Note:
Measured in the CGH35030F-AMP amplifier circuit, under 802.16 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, 5ms Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3, PAR = 9.8 dB @ 0.01% Probability on CCDF.

Features

- 3.3 - 3.9 GHz Operation
- 30 W Peak Power Capability
- 12 dB Small Signal Gain
- 4.0 W P_{AVE} < 2.0% EVM
- 25% Efficiency at 4 W P_{AVE}
- WiMAX Fixed Access 802.16-2004 OFDM
- WiMAX Mobile Access 802.16e OFDMA

Large Signal Models Available for ADS and MWO

RoHS compliant

4600 Silicon Drive | Durham, NC 27703 | Tel: +1.919.313.5300

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

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DSS}	120	V	25°C
Gate-to-Source Voltage	V_{GS}	-10, +2		
Power Dissipation	P_{DISS}	14	W	
Storage Temperature	T_{STG}	-65, +150	°C	
Operating Junction Temperature	T_J	225		
Maximum Forward Gate Current	I_{GMAX}	4.0	mA	25°C
Maximum Drain Current[1]	I_{DMAX}	3.0	A	
Soldering Temperature[2]	T_S	245	°C	
Screw Torque	τ	40	in-oz	
Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	4.8	°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 at wolfspeed.com/rf/document-library
[3] Measured for the CGH35030F at P_{DISS} = 14 W.

Electrical Characteristics (T_C = 25°C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1]						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V_{DC}	V_{DS} = 10 V, I_D = 7.2 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–		V_{DS} = 28 V, I_D = 120 mA
Saturated Drain Current	I_{DS}	5.8	7.0	–	A	V_{DS} = 6.0 V, V_{GS} = 2 V
Drain-Source Breakdown Voltage	V_{BR}	84	–	–	V_{DC}	V_{GS} = -8 V, I_D = 7.2 mA
RF Characteristics[2,3] (T_C = 25°C, F_0 = 3.5 GHz unless otherwise noted)						
Small Signal Gain	G_{SS}	10	11.5	–	dB	V_{DD} = 28 V, I_{DQ} = 120 mA, P_{AVE} = 23 dBm
Drain Efficiency[4]	η	20	25	–	%	V_{DD} = 28 V, I_{DQ} = 120 mA, P_{AVE} = 36 dBm
Back-Off Error Vector Magnitude	EVM	–	2.5	–		V_{DD} = 28 V, I_{DQ} = 120 mA, P_{AVE} = 23 dBm
Error Vector Magnitude		–	2.0	–		V_{DD} = 28 V, I_{DQ} = 120 mA, P_{AVE} = 36 dBm
Output Mismatch Stress	VSWR	–	–	10:1	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 120 mA
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	9.0	–	pF	V_{DS} = 28 V, V_{GS} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	2.6	–		
Feedback Capacitance	C_{GD}	–	0.4	–		

Notes:
[1] Measured on wafer prior to packaging.
[2] Measured in the CGH35030F-AMP test fixture
[3] Under 802.16 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, 5ms Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3, PAR = 9.8 dB @ 0.01% Probability on CCDF
[4] Drain Efficiency = P_{OUT} / P_{DC}

Typical WiMAX Performance

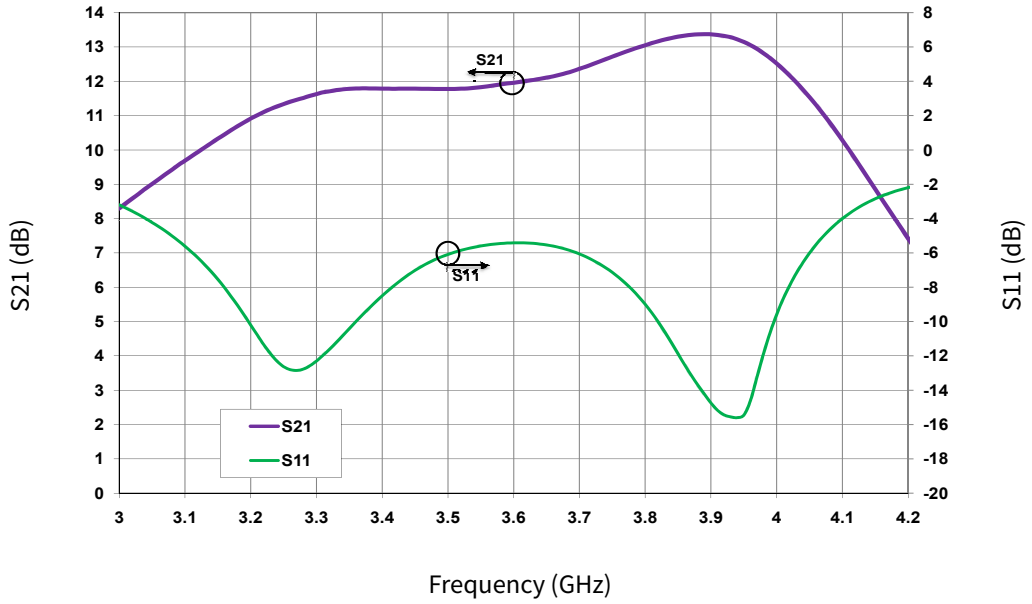


Figure 1. Gain and Return Loss vs Frequency measured in Broadband Amplifier Circuit CGH35030F-AMP
V_{DD} = 28 V, I_{DQ} = 120 mA

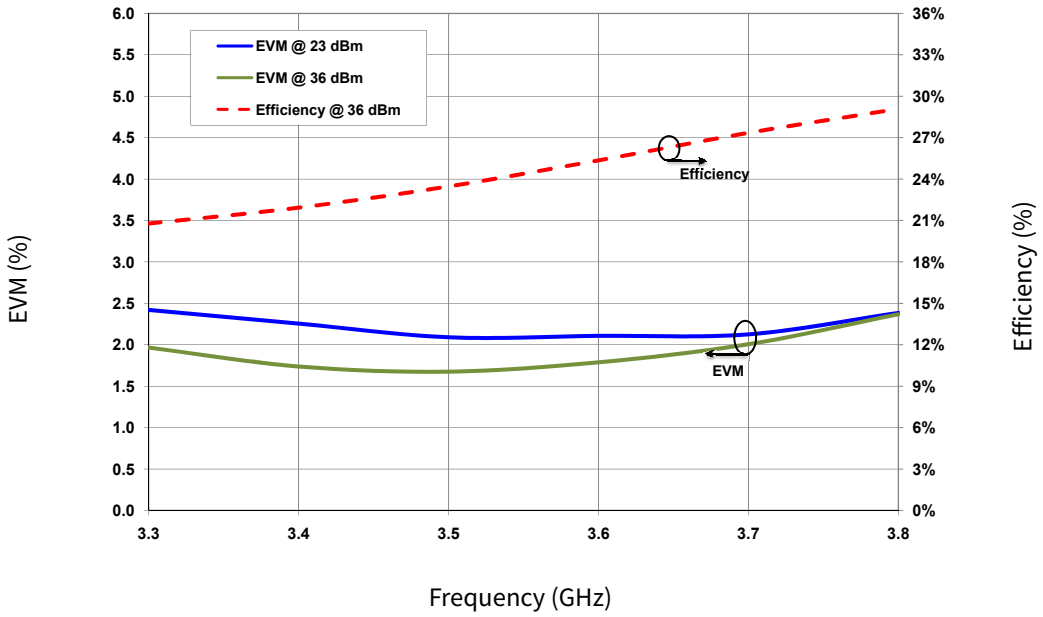


Figure 2. Typical EVM and Efficiency at 23 dBm and 36 dBm vs Frequency measured in Broadband Amplifier Circuit CGH35030F-AMP

Note:
[1] Under 802.16 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3, PAR = 9.8 dB @ 0.01% Probability on CCDF.

Typical WiMAX Performance

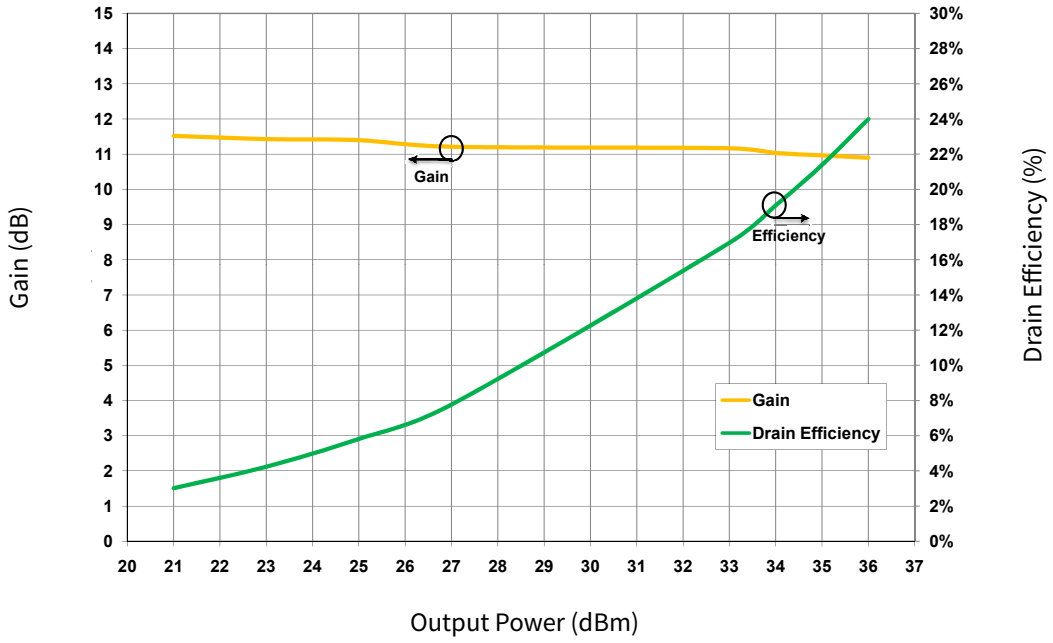


Figure 3. Gain and Return Loss vs Frequency measured in Broadband Amplifier Circuit CGH35030F-AMP
V_{DD} = 28 V, I_{DQ} = 120 mA

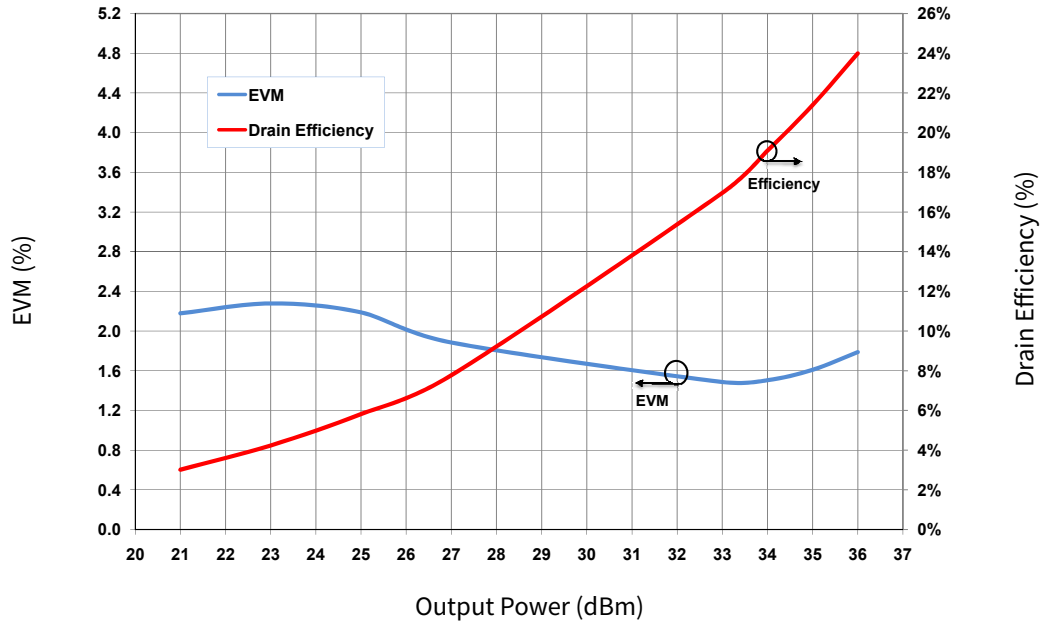


Figure 4. Typical EVM and Efficiency vs Frequency measured in Broadband Amplifier Circuit CGH35030F-AMP

Note:
[1] Under 802.16 OFDM, 3.5 MHz Channel BW, 1/4 Cyclic Prefix, 64 QAM Modulated Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3, PAR = 9.8 dB @ 0.01% Probability on CCDF.

Typical Performance

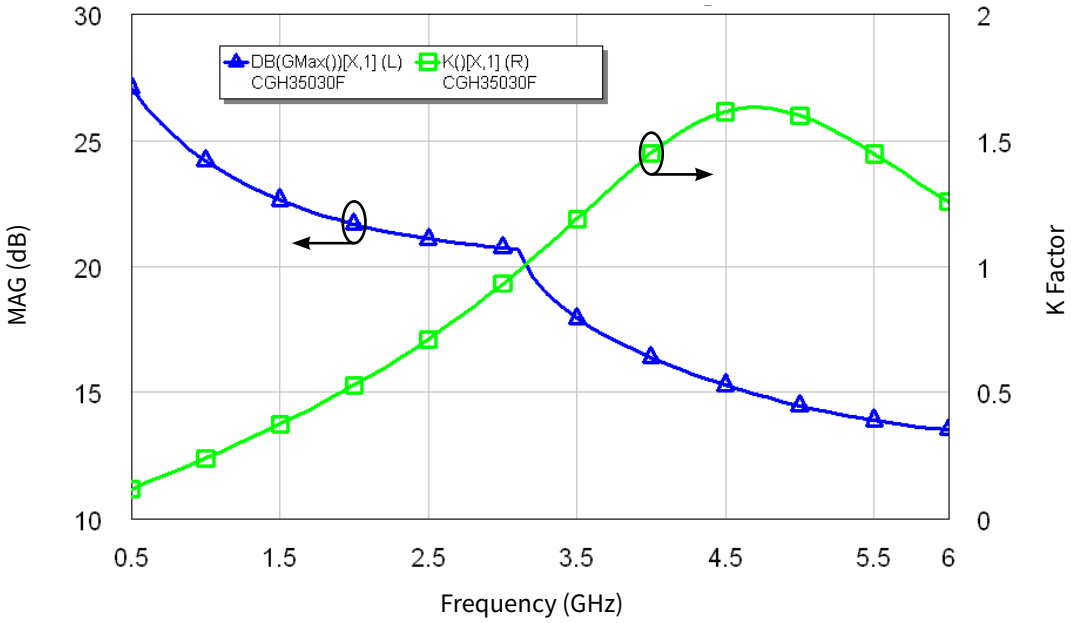


Figure 5. Simulated Maximum Available Gain and K Factor of the CGH35030F
V_{DD} = 28 V, I_{DQ} = 120 mA

Typical Noise Performance

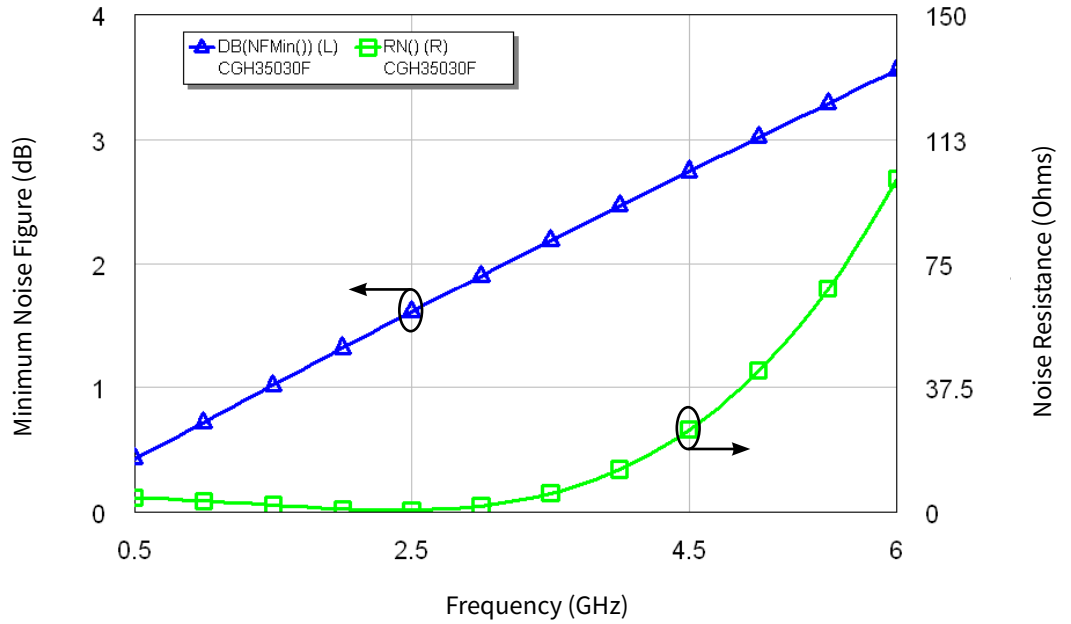
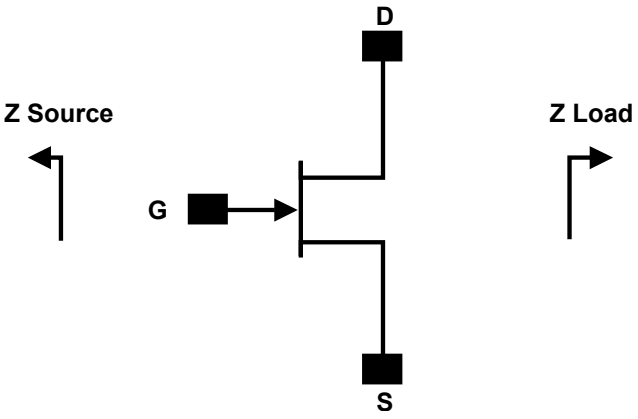


Figure 6. Simulated Minimum Noise Figure and Noise Resistance vs Frequency of the CGH35030F
V_{DD} = 28 V, I_{DQ} = 120 mA

Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
3300	3.3 - j9.2	13.4 - j11.4
3400	3.9 - j8.6	12.2 - j10.4
3500	4.5 - j8.5	11.1 - j9.4
3600	4.7 - j8.8	10.2 - j8.2
3700	4.3 - j9.0	9.5 - j7.1

Notes:
[1] V_{DD} = 28V, I_{DQ} = 120mA in the 440166 package.
[2] Impedences are extracted from the CGH35030F-AMP demonstration amplifier and are not source and load pull data derived from the transistor.

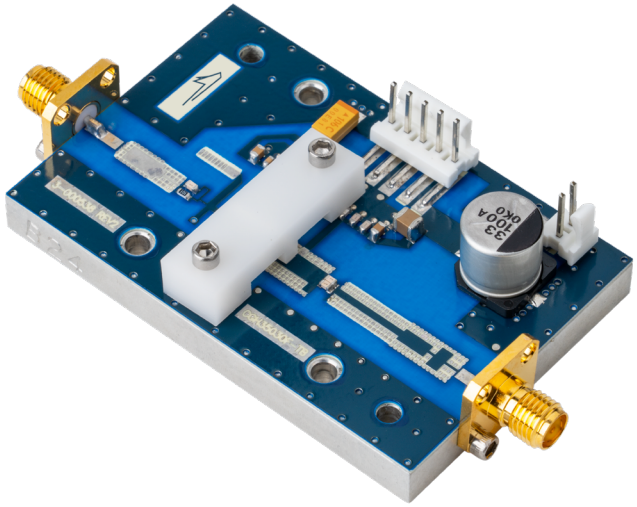
Electrostatic Discharge (ESD) Classifications

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

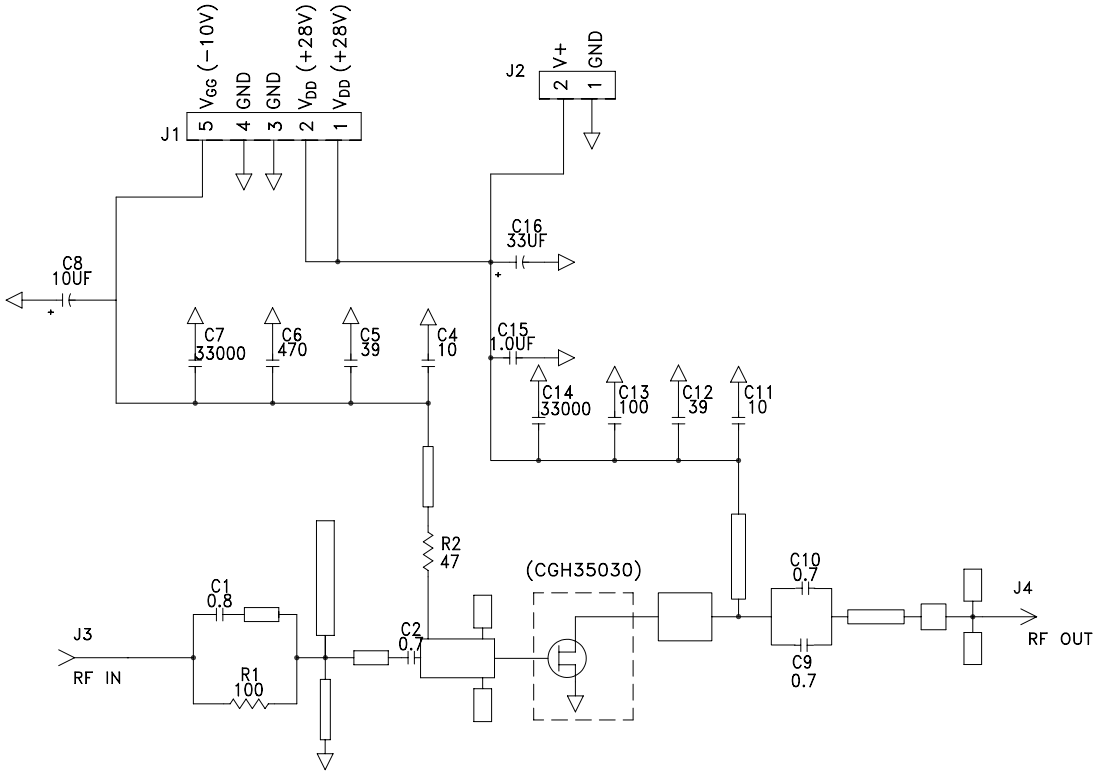
CGH35030F-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 1/16W, 0603, 1%, 100 OHMS	1
R2	RES, 1/16W, 0603, 1%, 47 OHMS	1
C6	CAP, 470pF, 10%, 100V, 0603	1
C17	CAP, 33µF, 20%, G CASE	1
C16	CAP, 1.0µF, 100V, 10%, X7R, 1210	1
C8	CAP 10µF 16V TANTALUM	1
C13	CAP, 100.0pF, +/-5%, 0603	1
C1	CAP, 0.8pF, +/-0.05pF, 0603, ATC	1
C2, C9, C10	CAP, 0.7pF, +/-0.05pF, 0603, ATC	3
C4, C11	CAP, 10.0pF,+/-5%, 0603, ATC	2
C5, C12	CAP, 39pF, +/-5%, 0603, ATC	2
C7, C14	CAP, 33000pF, 0805, 100V, X7R	2
J3, J4	CONN SMA STR PANEL JACK RECP	1
J2	HEADER RT>PLZ.1CEN LK 2 POS	1
J1	HEADER RT>PLZ .1CEN LK 5POS	1
-	PCB, RO4350B, Er = 3.48, h = 20 mil	1
-	CGH35030F	1

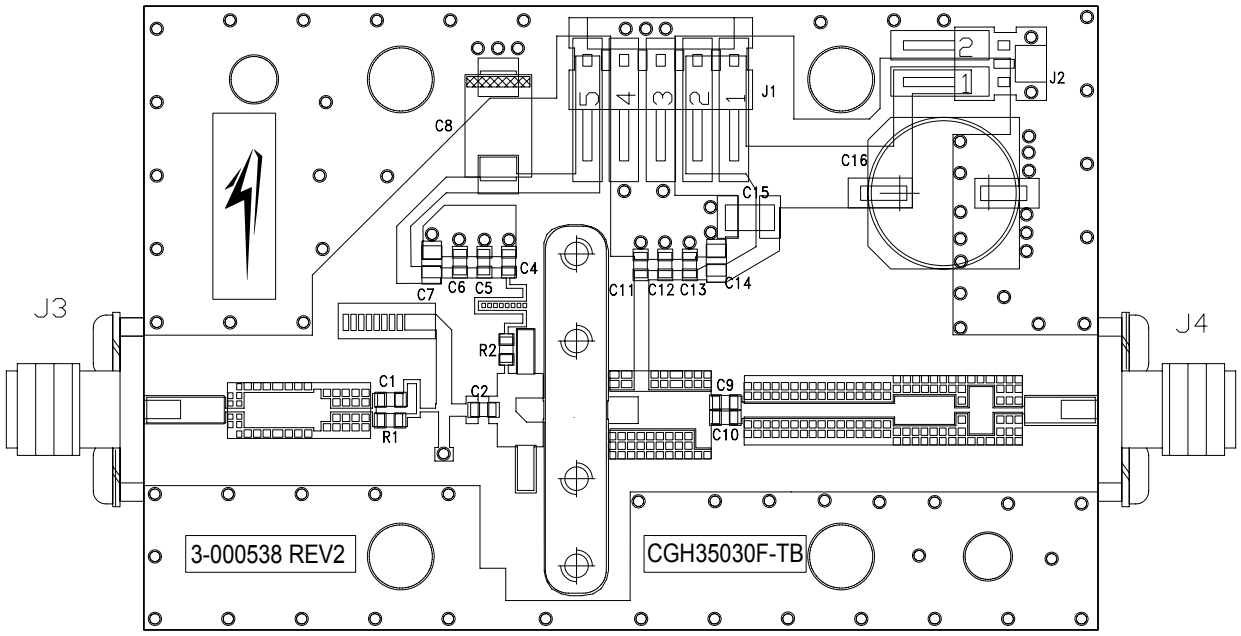
CGH35030F-AMP Demonstration Amplifier Circuit



CGH35030F-AMP Demonstration Amplifier Circuit Schematic



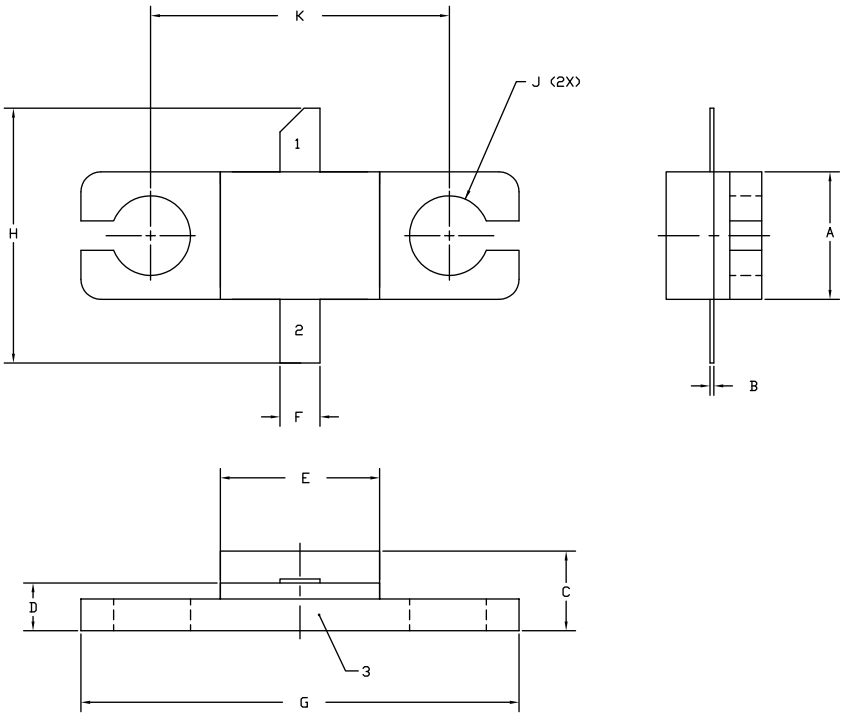
CGH35030F-AMP Demonstration Amplifier Circuit Outline



Typical Package S-Parameters for CGH35030F
(Small Signal, V_{DS} = 28 V, I_{DQ} = 120 mA, angle in degrees)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.909	-152.96	11.93	92.31	0.023	6.73	0.393	-144.30
600 MHz	0.907	-158.23	10.00	87.72	0.023	3.05	0.401	-147.24
700 MHz	0.907	-162.20	8.59	83.77	0.023	0.01	0.410	-149.13
800 MHz	0.907	-165.34	7.51	80.24	0.023	-2.59	0.420	-150.43
900 MHz	0.907	-167.92	6.66	76.99	0.023	-4.90	0.431	-151.37
1.0 GHz	0.908	-170.10	5.98	73.96	0.023	-6.97	0.442	-152.11
1.1 GHz	0.908	-172.00	5.41	71.09	0.022	-8.87	0.454	-152.74
1.2 GHz	0.909	-173.67	4.94	68.35	0.022	-10.62	0.466	-153.31
1.3 GHz	0.910	-175.19	4.53	65.71	0.022	-12.23	0.478	-153.87
1.4 GHz	0.911	-176.58	4.18	63.16	0.022	-13.73	0.490	-154.44
1.5 GHz	0.912	-177.86	3.88	60.70	0.021	-15.13	0.503	-155.02
1.6 GHz	0.913	-179.07	3.61	58.30	0.021	-16.42	0.515	-155.64
1.7 GHz	0.914	179.79	3.38	55.96	0.020	-17.62	0.528	-156.28
1.8 GHz	0.915	178.71	3.17	53.68	0.020	-18.72	0.540	-156.96
1.9 GHz	0.916	177.66	2.98	51.45	0.020	-19.73	0.552	-157.67
2.0 GHz	0.917	176.65	2.81	49.27	0.019	-20.64	0.564	-158.41
2.1 GHz	0.918	175.67	2.66	47.14	0.019	-21.45	0.576	-159.17
2.2 GHz	0.919	174.72	2.52	45.05	0.018	-22.17	0.587	-159.97
2.3 GHz	0.921	173.78	2.39	43.00	0.018	-22.78	0.598	-160.79
2.4 GHz	0.922	172.86	2.27	40.99	0.017	-23.28	0.609	-161.62
2.5 GHz	0.923	171.95	2.16	39.02	0.017	-23.68	0.619	-162.48
2.6 GHz	0.924	171.05	2.06	37.08	0.016	-23.96	0.629	-163.36
2.7 GHz	0.925	170.16	1.97	35.18	0.016	-24.11	0.639	-164.24
2.8 GHz	0.926	169.28	1.89	33.31	0.015	-24.14	0.648	-165.15
2.9 GHz	0.927	168.41	1.81	31.47	0.015	-24.04	0.657	-166.06
3.0 GHz	0.927	167.53	1.74	29.66	0.015	-23.79	0.666	-166.98
3.2 GHz	0.929	165.79	1.61	26.12	0.014	-22.85	0.682	-168.84
3.4 GHz	0.931	164.05	1.49	22.69	0.013	-21.25	0.697	-170.73
3.6 GHz	0.932	162.30	1.39	19.35	0.012	-18.94	0.711	-172.64
3.8 GHz	0.933	160.54	1.30	16.10	0.012	-15.90	0.724	-174.56
4.0 GHz	0.934	158.76	1.23	12.92	0.011	-12.15	0.735	-176.49
4.2 GHz	0.935	156.96	1.16	9.80	0.011	-7.76	0.746	-178.43
4.4 GHz	0.936	155.14	1.10	6.75	0.011	-2.91	0.755	179.63
4.6 GHz	0.937	153.27	1.04	3.74	0.011	2.16	0.764	177.67
4.8 GHz	0.937	151.38	0.99	0.78	0.011	7.15	0.772	175.70
5.0 GHz	0.938	149.44	0.95	-2.15	0.012	11.82	0.779	173.71
5.2 GHz	0.938	147.46	0.91	-5.05	0.013	15.96	0.786	171.71
5.4 GHz	0.938	145.42	0.88	-7.92	0.014	19.45	0.791	169.69
5.6 GHz	0.938	143.34	0.85	-10.79	0.015	22.27	0.796	167.65
5.8 GHz	0.938	141.19	0.82	-13.65	0.016	24.42	0.801	165.58
6.0 GHz	0.937	138.98	0.79	-16.50	0.017	25.96	0.805	163.48

Product Dimensions CGH35030F (Package Type — 440166)



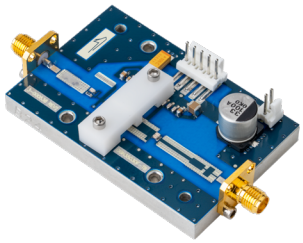
NOTES:

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.
5. ALL PLATED SURFACES ARE NI/AU

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.155	0.165	3.94	4.19
B	0.004	0.006	0.10	0.15
C	0.115	0.135	2.92	3.43
D	0.057	0.067	1.45	1.70
E	0.195	0.205	4.95	5.21
F	0.045	0.055	1.14	1.40
G	0.545	0.555	13.84	14.09
H	0.280	0.360	7.11	9.14
J	ø .100		2.54	
K	0.375		9.53	

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

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGH35030F	GaN HEMT	Each	
CGH35030F-AMP	Test board with GaN HEMT installed	Each	

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