CGH35030F

30 W, 3300-3900 MHz, 28V, GaN HEMT for WiMAX

Cree'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 3.3-3.9GHz WiMAX and BWA amplifier applications. The transistor is supplied in a ceramic/metal flange package.

Package Type: 440166
PN: CGH35030F

Typical Performance Over 3.3-3.8GHz (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, 5 ms Burst, Symbol Length of 59, Coding Type RS-CC, Coding Rate Type 2/3, PAR = 9.8 dB @ 0.01 % Probability on CCDF.

Features

RoHS COMPLIANT

- 3.3 - 3.9 GHz Operation
- 30 W Peak Power Capability
- 12 dB Small Signal Gain
- 4.0 W P_{AVE} at < 2.0 % EVM
- 25 % Drain 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

Rev 4.0 – May 2015

CREE

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

Parameter	Symbol	Rating	Units	Units
Drain-Source Voltage	V_{DSS}	84	Volts	25˚C
Gate-to-Source Voltage	V_{GS}	-10, +2	Volts	25˚C
Power Dissipation	P_{DISS}	14	Watts	
Storage Temperature	T_{STG}	-65, +150	˚C	
Operating Junction Temperature	T_J	225	˚C	
Maximum Forward Gate Current	I_{GMAX}	4.0	mA	25˚C
Maximum Drain Current[1]	I_{DMAX}	3.0	A	25˚C
Soldering Temperature[2]	T_S	245	˚C	
Screw Torque	τ	60	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 www.cree.com/RF/Documnet-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_{DC}	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}	120	–	–	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_1	–	2.5	–	%	V_{DD} = 28 V, I_{DQ} = 120 mA, P_{AVE} = 23 dBm
Error Vector Magnitude	EVM_2	–	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	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	0.4	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz

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, 5 ms 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} / $P_{DC.}$

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Typical WiMAX Performance

Figure 1.- Gain and Return Loss vs Frequency measured in Broadband Amplifier Circuit CGH35030F-AMP1
V_{DD} = 28 V, I_{DQ} = 120 mA

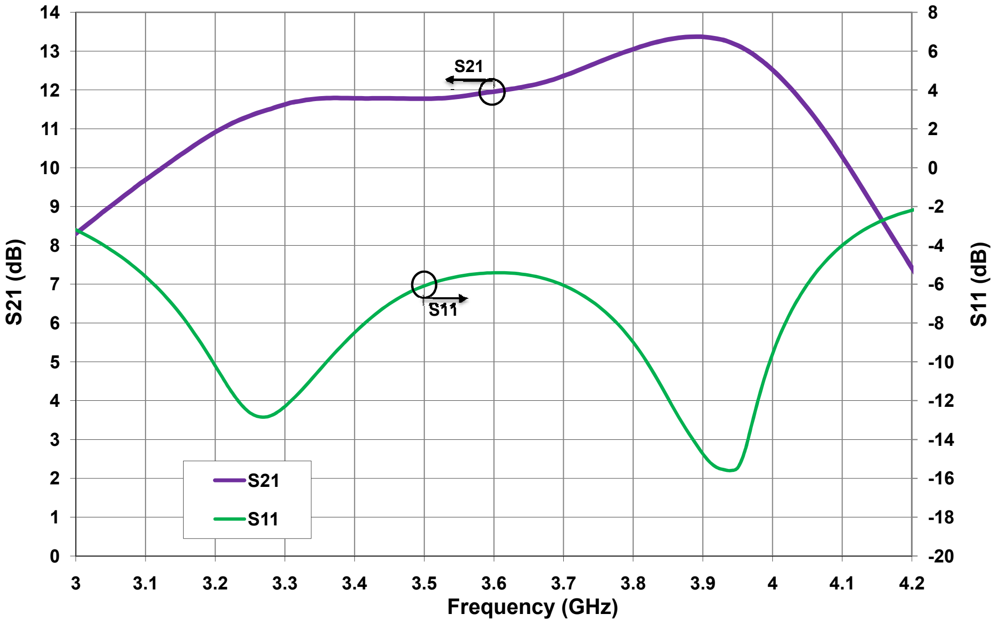
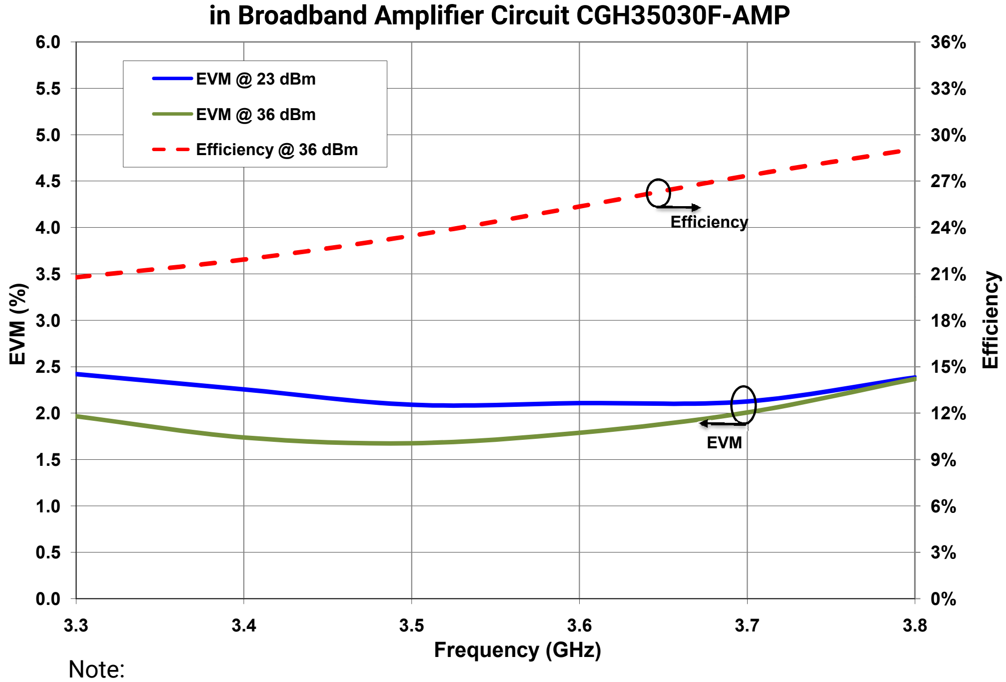


Figure 2.- Typical EVM and Efficiency at 23 dBm and 36 dBm vs Frequency measured in Broadband Amplifier Circuit CGH35030F-AMP



Note:
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.

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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

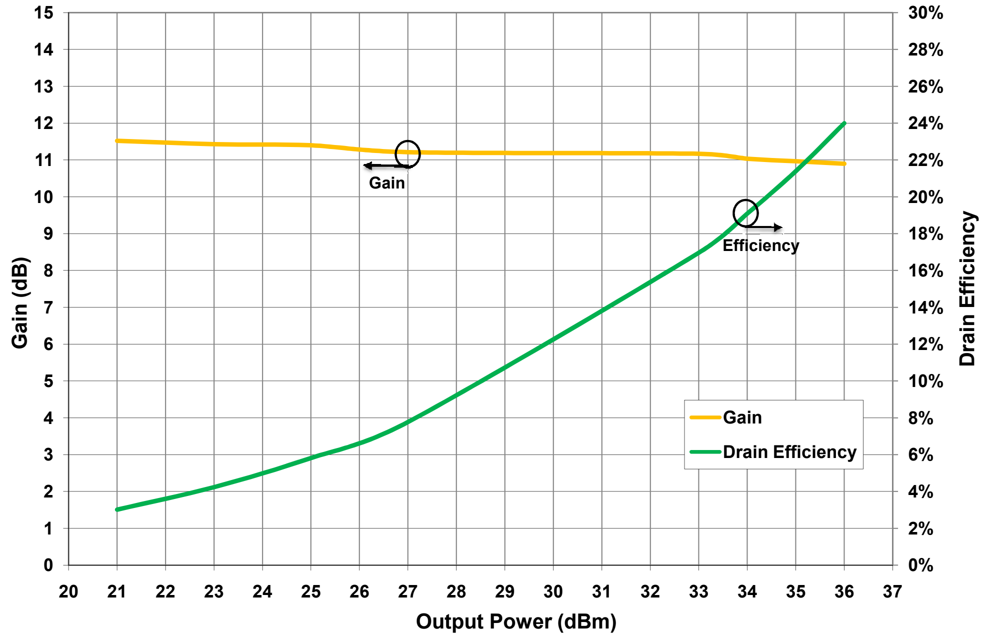
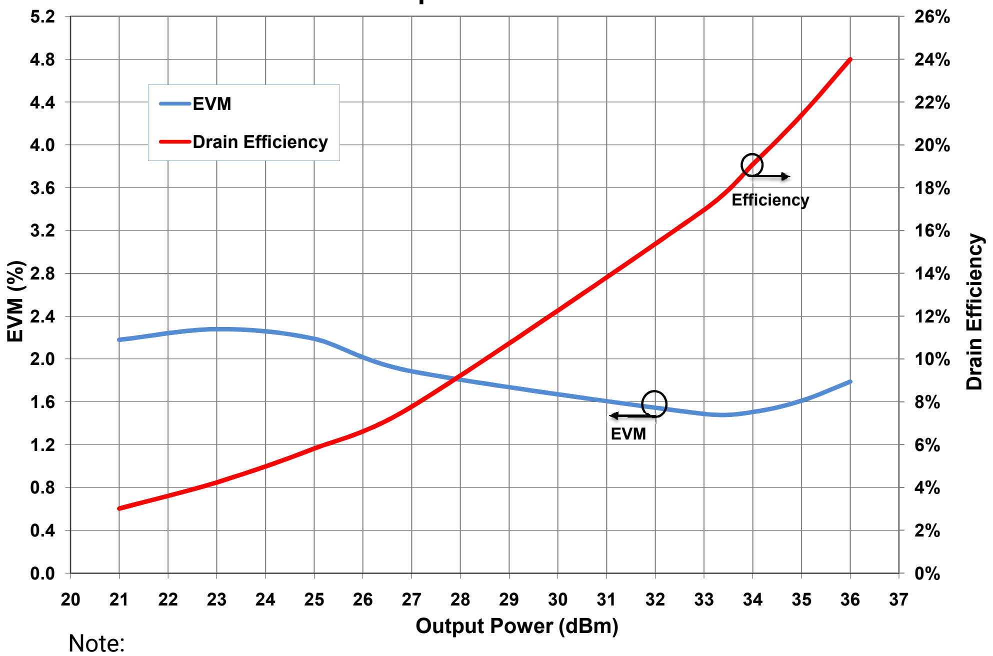


Figure 4.- Typical EVM and Efficiency vs Frequency measured in Broadband Amplifier Circuit CGH35030F-AMP



Note:
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.

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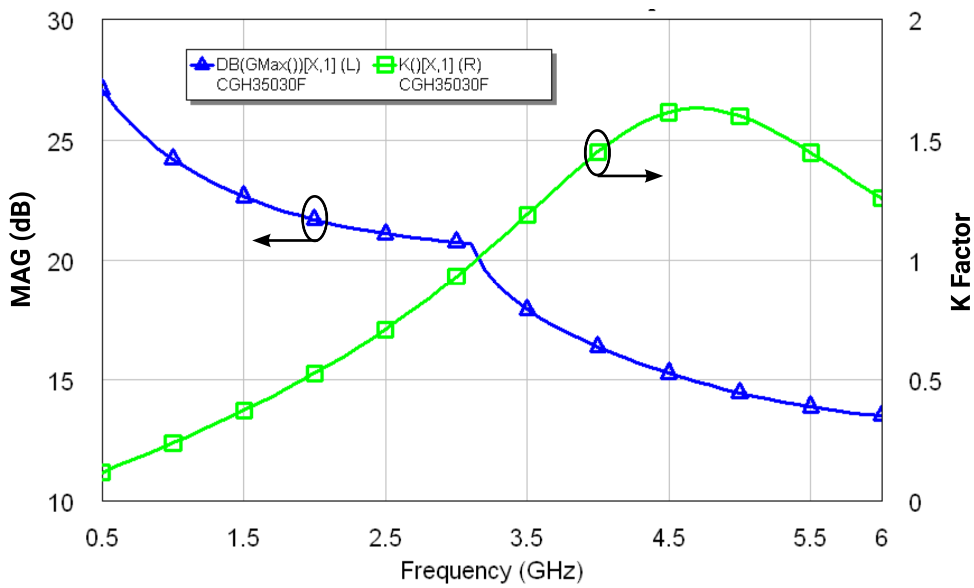
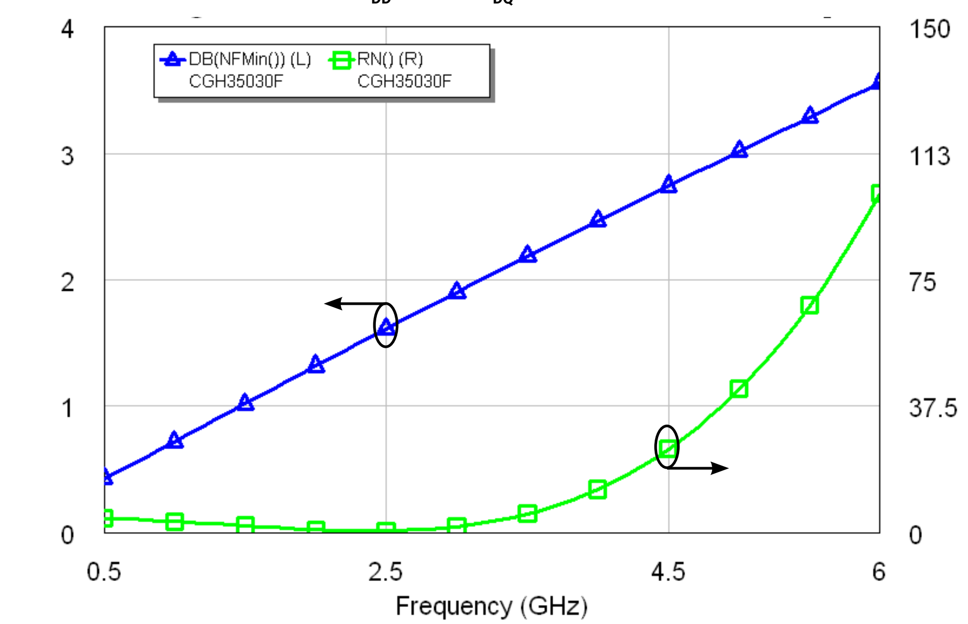
Typical Performance

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 CGH35030
V_{DD} = 28 V, I_{DQ} = 120 mA



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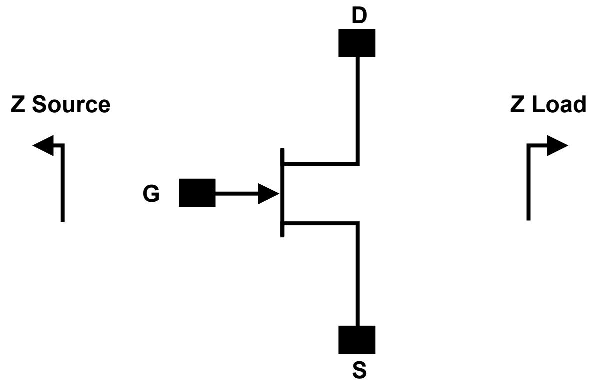
Source and Load Impedances



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

Note 1. V_{DD} = 28V, I_{DQ} = 120 mA in the 440166 package.
Note 2. Impedences are extracted from the CGH35030-AMP demonstration amplifier and are not source and load pull date derived from the transistor.

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

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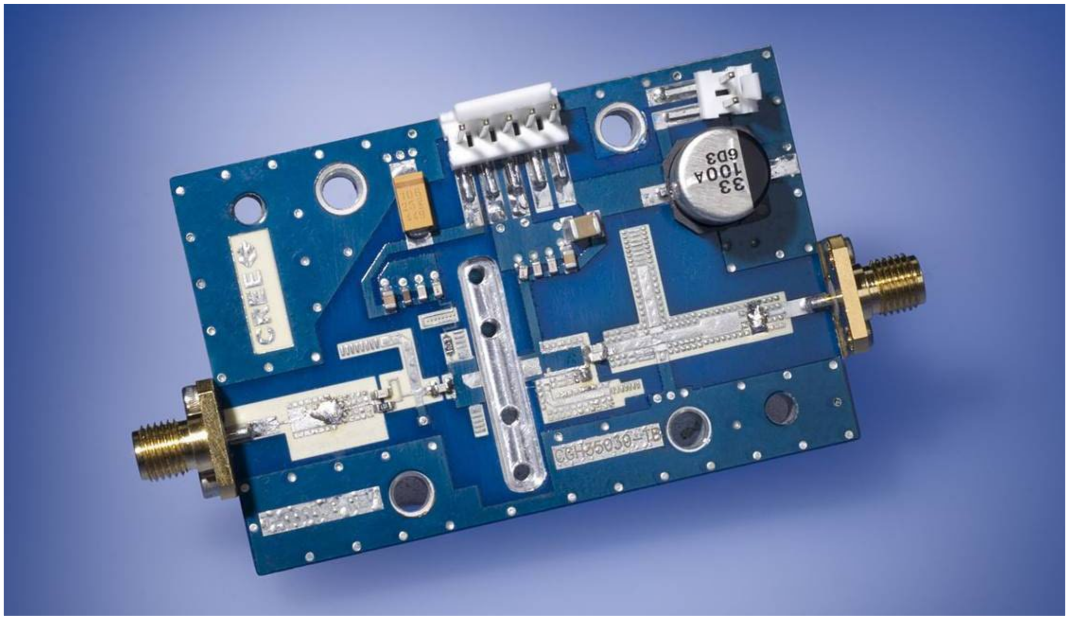
CGH35030F-AMP Demonstration Amplifier Circuit Bill of Materials

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, 33 UF, 20%, G CASE	1
C16	CAP, 1.0UF, 100V, 10%, X7R, 1210	1
C8	CAP 10UF 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



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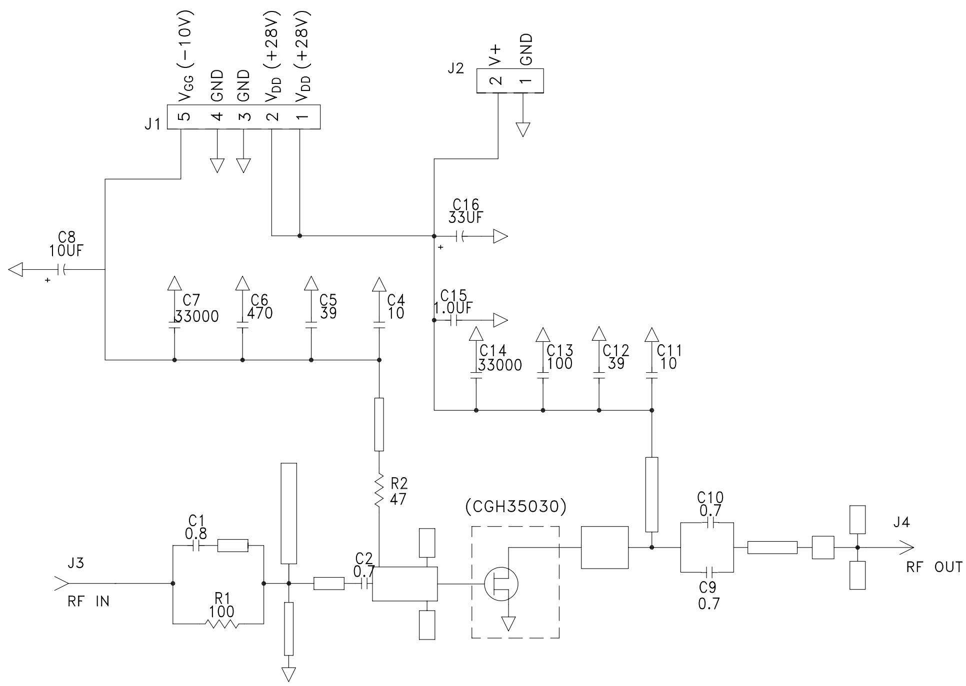
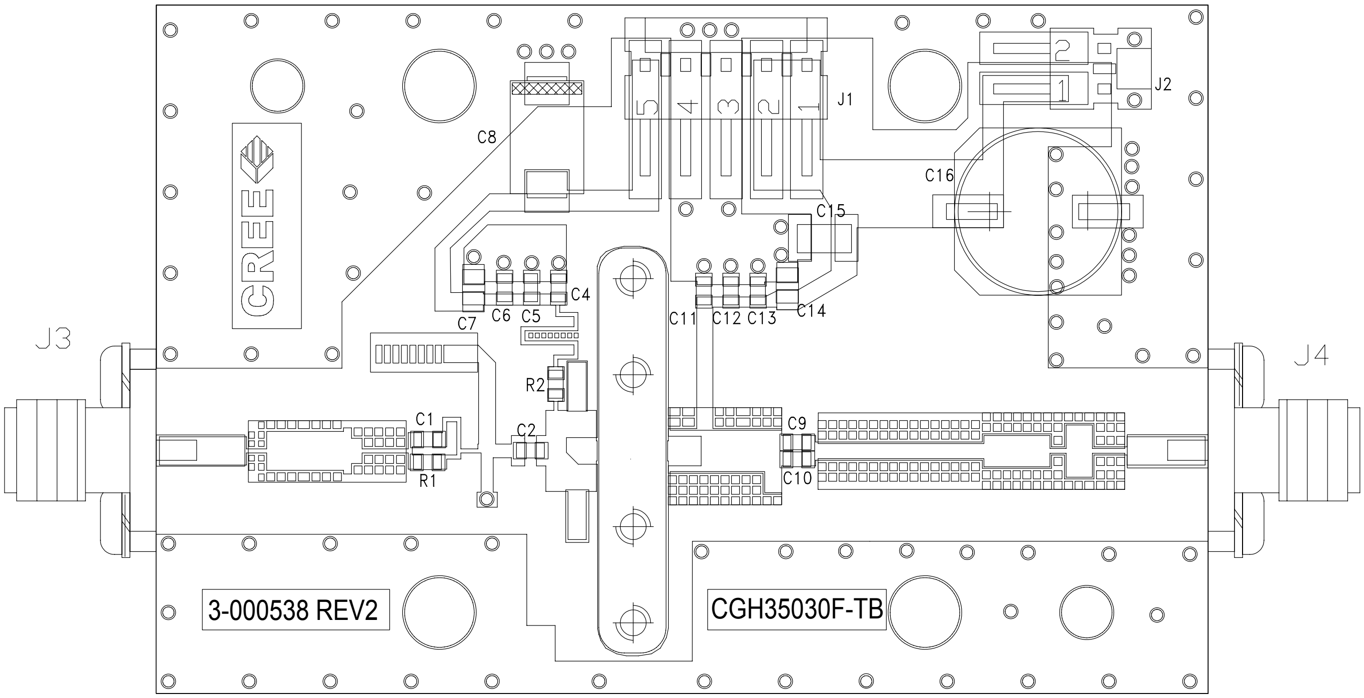
CGH35030F-AMP Demonstration Amplifier Circuit Schematic



CGH35030F-AMP Demonstration Amplifier Circuit Outline



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Typical Package S-Parameters for CGH35030
(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

To download the s-parameters in s2p format, go to the CGH35030F Product Page and click on the documentation tab.

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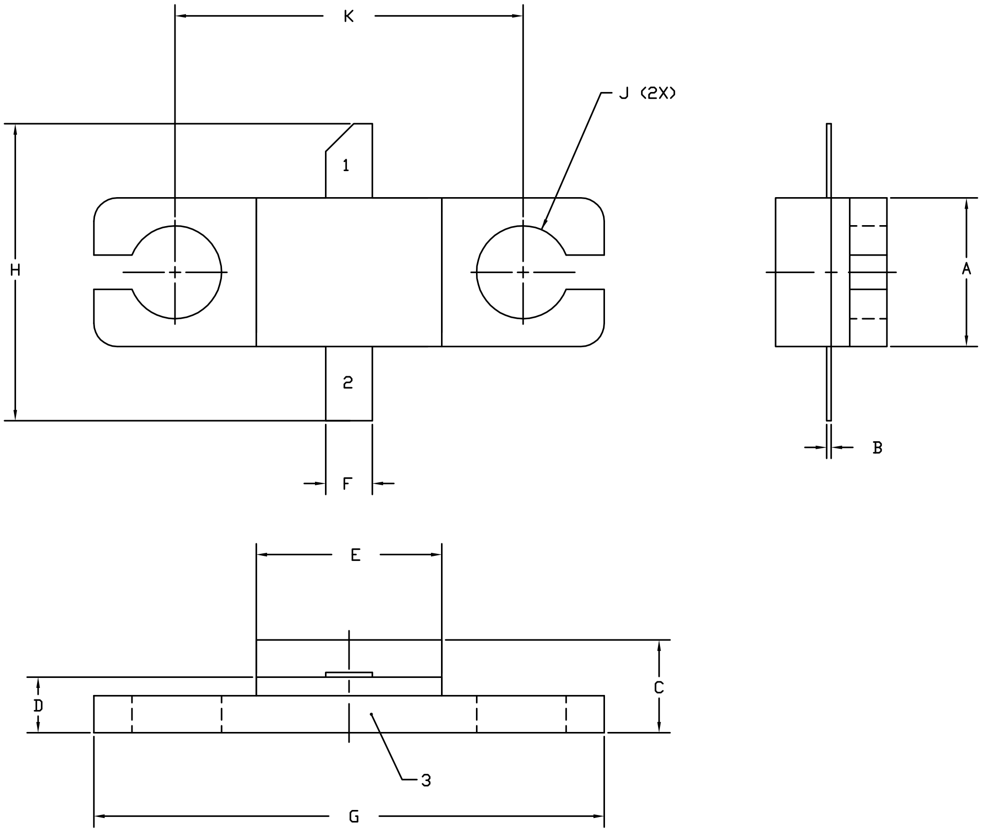
Product Dimensions CGH35030F (Package Type — 440166)



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

DIM	INCHES		MILLIMETERS	
	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

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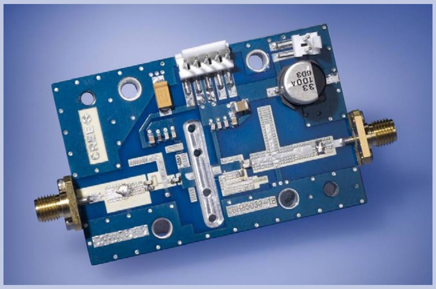
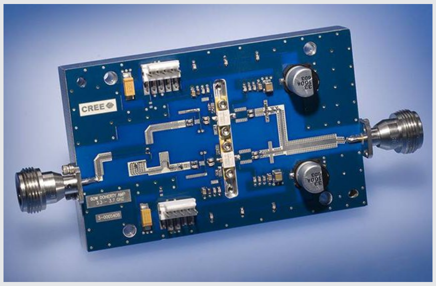
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGH35030F	GaN HEMT	Each	
CGH35030-TB	Test board without GaN HEMT	Each	
CGH35030F-AMP	Test board with GaN HEMT installed	Each	

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