CGH27060F

60 W Peak, 28V, GaN HEMT for Linear Communications from VHF to 3 GHz

Cree's CGH27060F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically for high efficiency, high gain and wide bandwidth capabilities, which makes the CGH27060F ideal for VHF, Comms, 3G, 4G, LTE, 2.3-2.9GHz WiMAX and BWA amplifier applications. The unmatched transistor is supplied in a ceramic/metal flange package.

Package Type: 440193
PN: CGH27060F

Typical Performance Over 2.3-2.7GHz (T_C = 25 °C) of Demonstration Amplifier

Parameter	2.3 GHz	2.4 GHz	2.5 GHz	2.6 GHz	2.7 GHz	Units
Small Signal Gain	15.1	14.7	14.3	14.3	14.5	dB
EVM @ 39 dBm	2.35	2.16	2.01	2.13	2.82	%
Drain Efficiency @ 39 dBm	28.3	27.6	27.3	26.7	26.3	%
Input Return Loss	10.0	7.3	6.0	7.0	10.3	dB

Note:
Measured in the CGH27060F-TB 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

- VHF - 3.0 GHz Operation
- 14 dB Small Signal Gain
- 8.0 W P_{AVE} at < 2.0 % EVM
- 27 % Drain Efficiency at 8 W Average Power
- WiMAX Fixed Access 802.16-2004 OFDM
- WiMAX Mobile Access 802.16e OFDMA

Large Signal Models Available for SiC & GaN

Rev 4.2 - July 2014

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

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DSS}	84	Volts	25˚C
Gate-to-Source Voltage	V_{GS}	-10, +2	Volts	25˚C
Storage Temperature	T_{STG}	-65, +150	˚C	
Operating Junction Temperature	T_J	225	˚C	
Maximum Forward Gate Current	I_{GMAX}	15	mA	25˚C
Maximum Drain Current[1]	I_{DMAX}	6	A	25˚C
Soldering Temperature[2]	T_S	245	˚C	
Screw Torque	τ	80	in-oz	
Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	2.8	˚C/W	85˚C
Case Operating Temperature[3]	T_C	-40, +150	˚C	

Note:
[1] Current limit for long term, reliable operation
[2] Refer to the Application Note on soldering at www.cree.com/products/wireless_appnotes.asp
[3] Measured for the CGH27060F at P_{DISS} = 56 W.

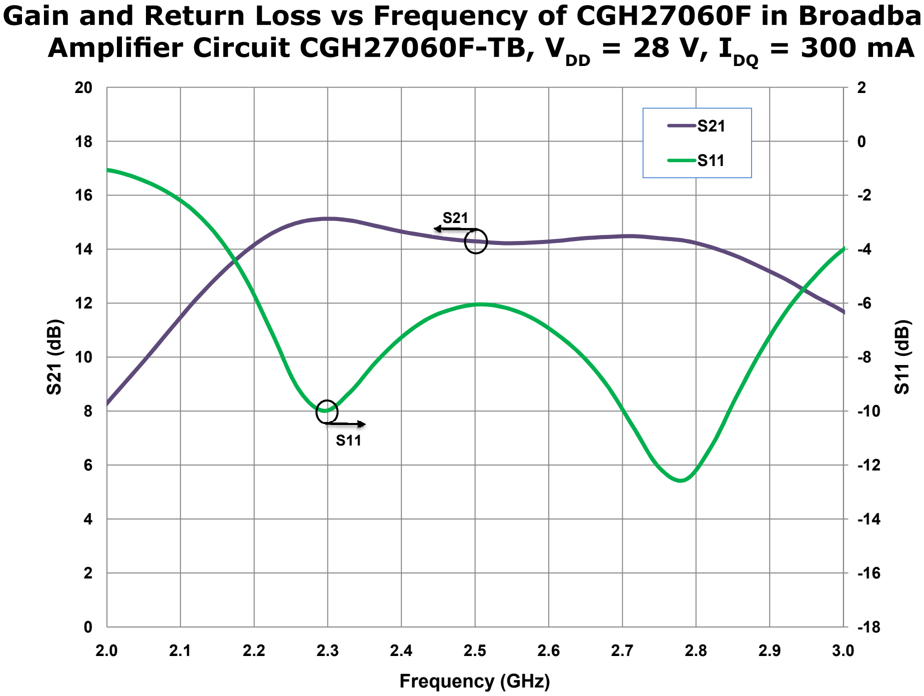
Electrical Characteristics (T_C = 25˚C)

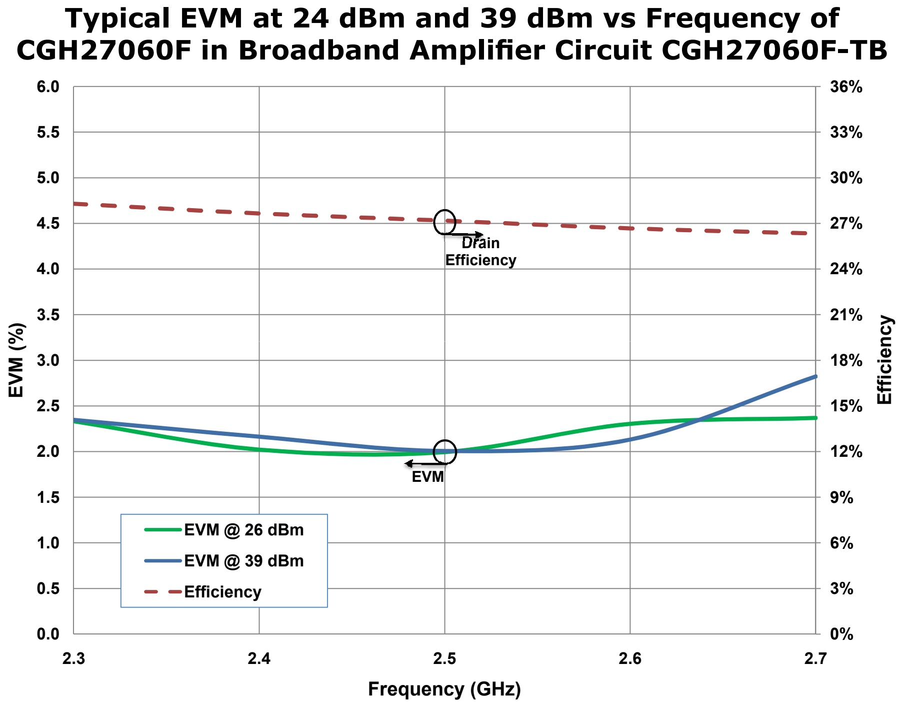
Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1]						
Gate Threshold Voltage	$V_{GS(th)}$	-3.5	-3.0	-2.0	VDC	V_{DS} = 10 V, I_D = 14.4 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	VDC	V_{DD} = 28 V, I_{DQ} = 300 mA
Saturated Drain Current	I_{DS}	11.6	14.0	-	A	V_{DS} = 6.0 V, V_{GS} = 2 V
Drain-Source Breakdown Voltage	V_{BR}	120	–	–	VDC	V_{GS} = -8 V, I_D = 14.4 mA
RF Characteristics[2,3] (T_C = 25˚C, F_0 = 2.5 GHz unless otherwise noted)						
Small Signal Gain	G_{SS}	11.0	13.0	–	dB	V_{DD} = 28 V, I_{DQ} = 300 mA
Drain Efficiency[4]	η	21	24	–	%	V_{DD} = 28 V, I_{DQ} = 300 mA, P_{AVE} = 8 W
Error Vector Magnitude	EVM	–	2.0	–		V_{DD} = 28 V, I_{DQ} = 300 mA, P_{AVE} = 8 W
Output Mismatch Stress	VSWR	–	–	10 : 1	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 300 mA, P_{AVE} = 8 W
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	19.0	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	5.9	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	0.8	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz

Notes:
[1] Measured on wafer prior to packaging.
[2] Measured in the CGH27060F-TB 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} / $P_{DC.}$

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Typical WiMAX Performance





Note:
Under 802.16-2004 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.

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Durham, North Carolina, USA 27703
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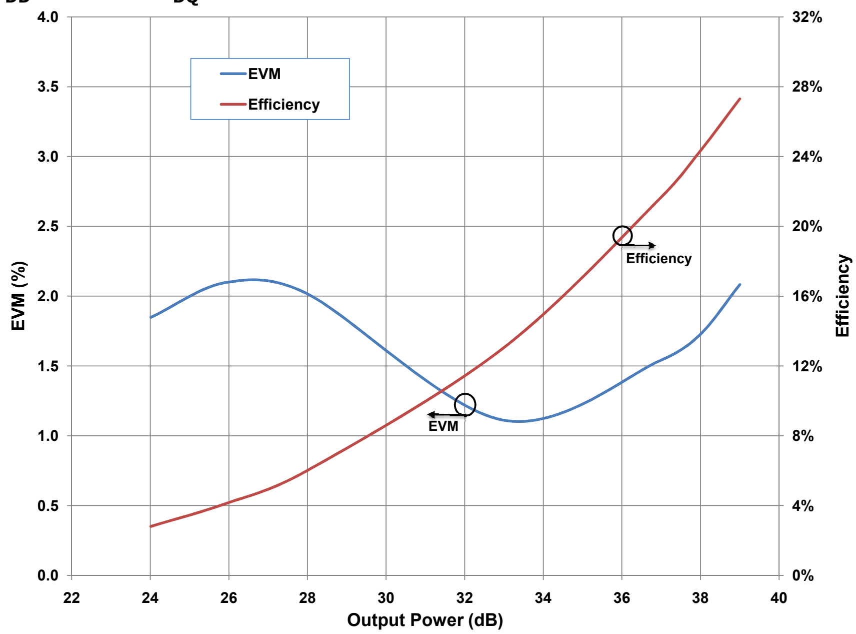
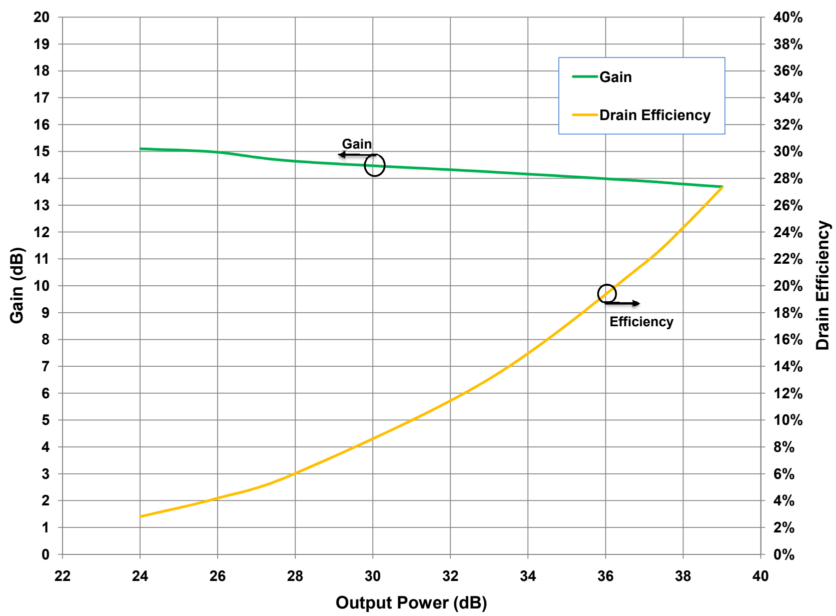
Typical WiMAX Performance

Drain Efficiency and EVM vs Output Power of the CGH27060F in the CGH27060F-TB
V_{DD} = 28 V, I_{DQ} = 300 mA, 802.16-2004 OFDM, PAR = 9.8 dB



Typical Gain and Efficiency versus Power Output of CGH27060F in the CGH27060F-TB
V_{DD} = 28 V, I_{DQ} = 300 mA, 802.16-2004 OFDM, PAR=9.8 dB



Note:
Under 802.16-2004 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.

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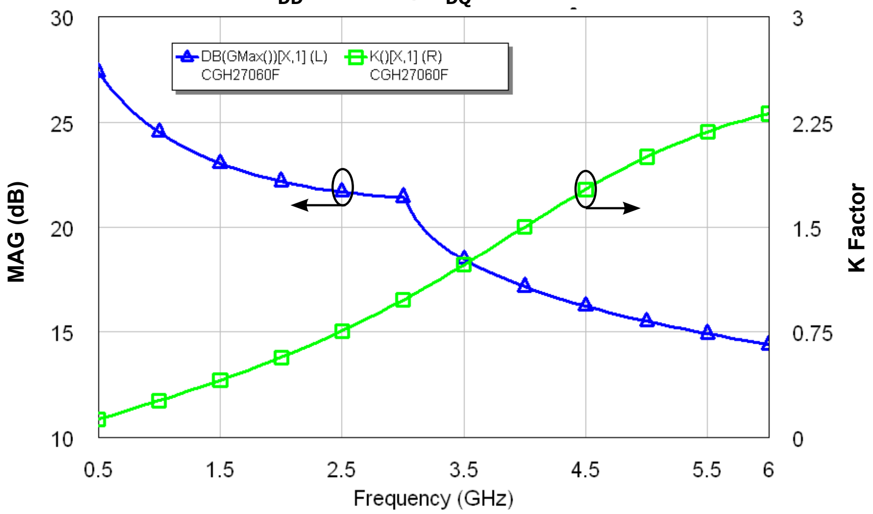
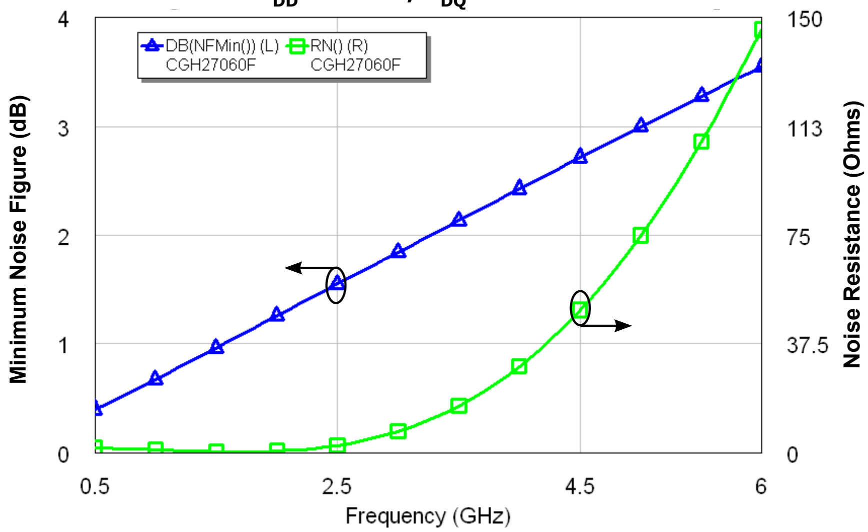
Typical Performance Data

Simulated Maximum Available Gain and K Factor of the CGH27060F
V_{DD} = 28 V, I_{DQ} = 300 mA



Typical Noise Performance

Simulated Minimum Noise Figure and Noise Resistance vs Frequency of the CGH27015
V_{DD} = 28 V, I_{DQ} = 100 mA



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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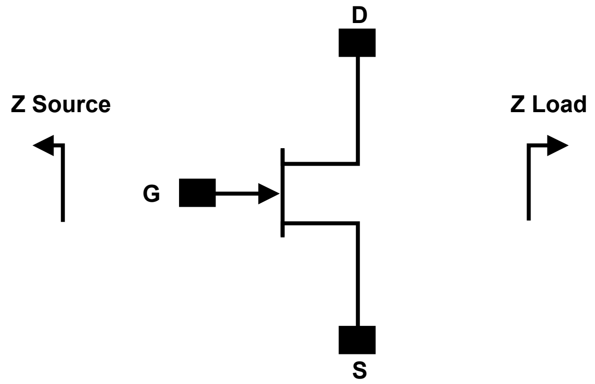
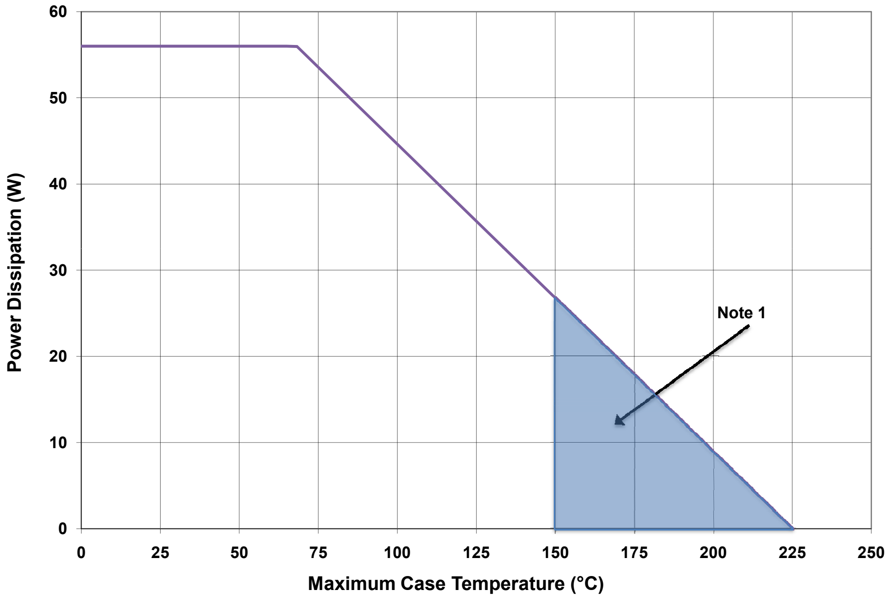
Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
500	3.34 + j4.56	10.8 + j8.24
1000	2.07 + j0.05	6.18 + j4.17
2000	1.3 – j3.37	4.65 + j0.05
3000	1.64 – j8.15	4.75 – j3.4
4000	1.9 – j10.8	4.56 – j7.9

Note 1. V_{DD} = 28V, I_{DQ} = 300mA in the 440193 package.
Note 2. Optimized for P_{SAT} and PAE.
Note 3. When using this device at low frequency, series resistors should be used to maintain amplifier stability.

CGH27060 Power Dissipation De-rating Curve



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

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Durham, North Carolina, USA 27703
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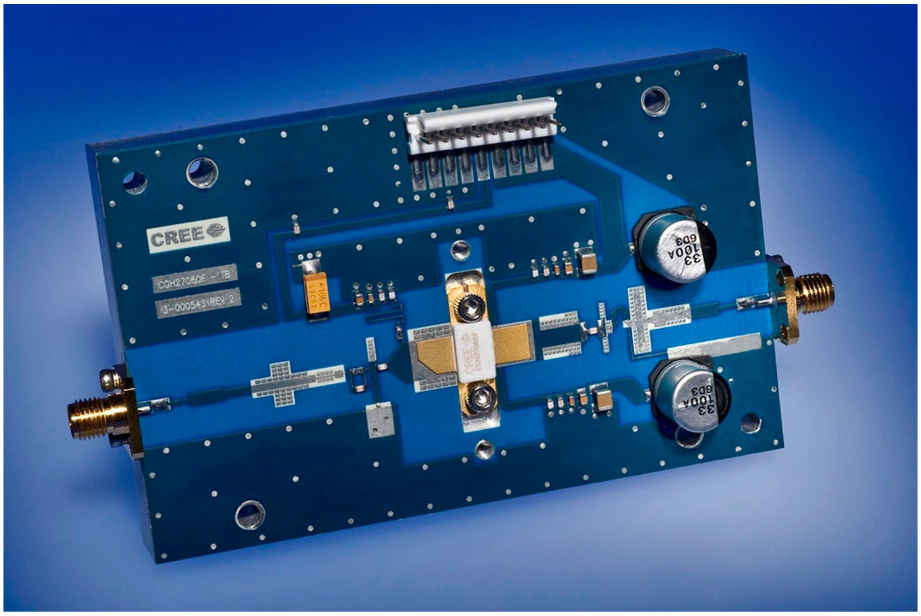
CGH27060F-TB Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 1/16W, 0603, 1%, 5.1 OHMS	1
R2	RES, 1/16W, 0603, 1%, 100 OHMS	1
C6,C13,C19	CAP, 470PF, 10%,100V, 0603	3
C16,C22	CAP, 33 UF, 20%, G CASE	1
C15,C21	CAP, 1.0UF, 100V, 10%, X7R, 1210	1
C8	CAP 10UF 16V TANTALUM	1
C10	CAP, 8.2pF, +/-5%, 100B	1
C1	CAP, 0.9pF, +/-0.05pF, 0603	1
C2	CAP, 2.2pF, +/-0.1pF, 0603	1
C4,C11,C17	CAP, 10.0pF,+/-5%, 0603	3
C5,C12,C18,C30,C31	CAP, 82pF, +/-5%, 0603	5
C7,C14,C20	CAP,33000PF, 0805,100V, X7R	3
J2,J3	CONN SMA STR PANEL JACK RECP	1
J1	HEADER RT>PLZ .1CEN LK 9POS	1
-	PCB, RO4350B, Er = 3.48, h = 20 mil	1
-	CGH27060F	1

CGH27060F-TB Demonstration Amplifier Circuit



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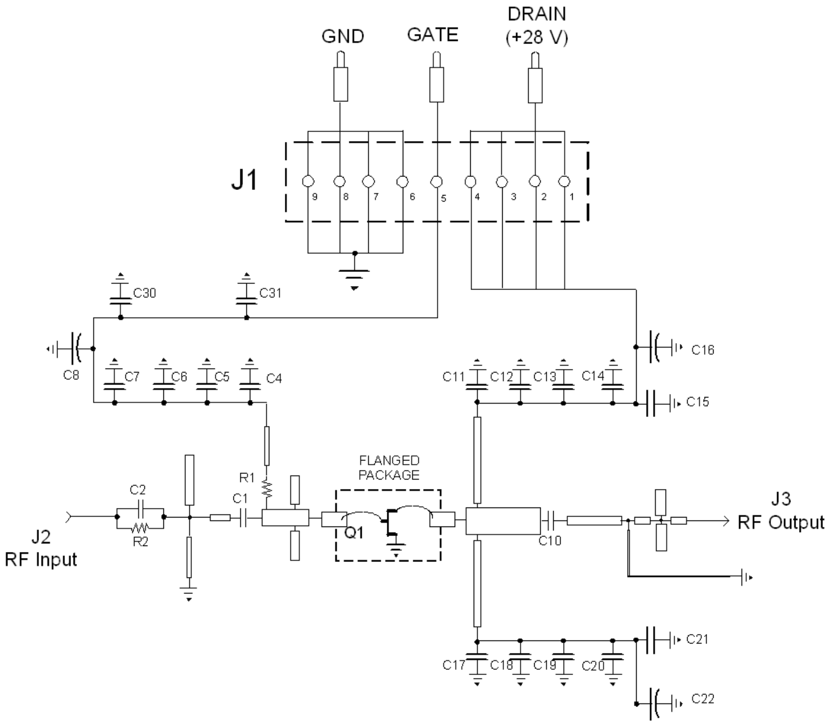
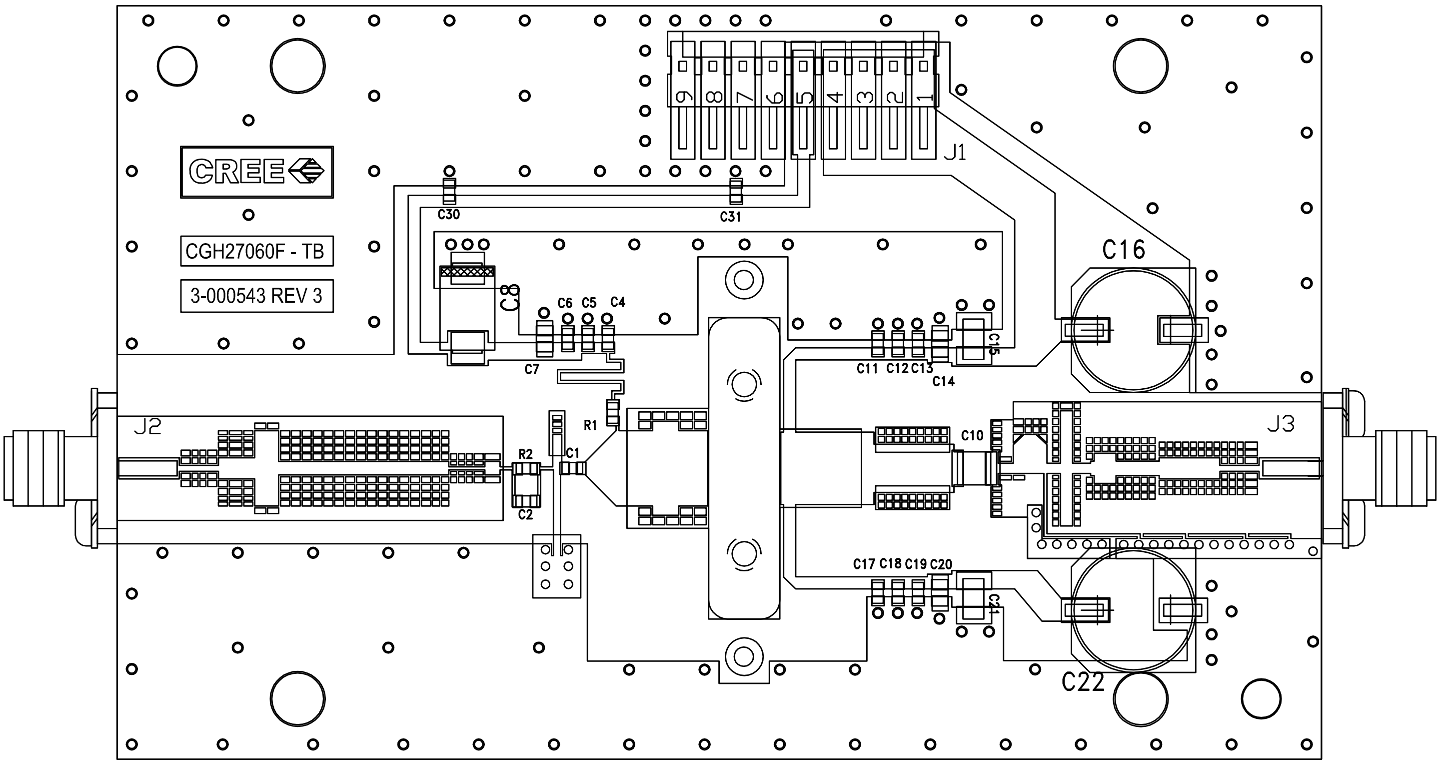
CGH27060F-TB Demonstration Amplifier Circuit Schematic



CGH27060F-TB Demonstration Amplifier Circuit Outline



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Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
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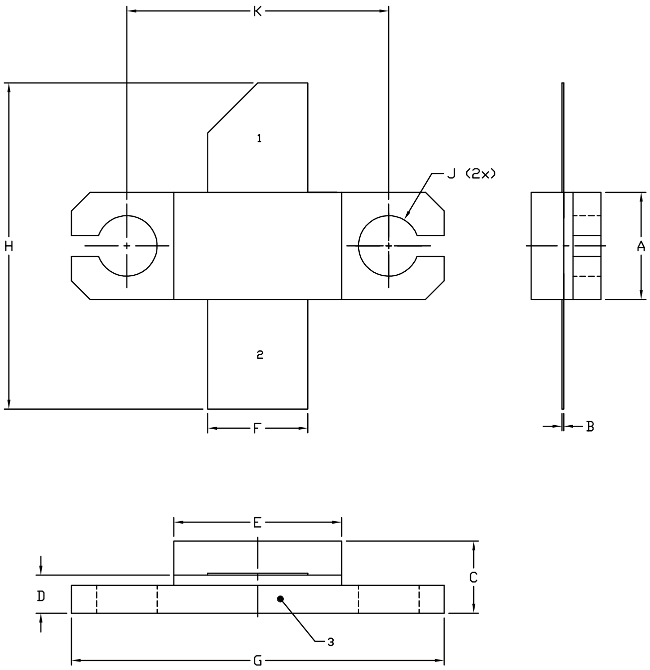
Typical Package S-Parameters for CGH27060
(Small Signal, V_{DS} = 28 V, I_{DQ} = 300 mA, angle in degrees)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.935	-171.10	7.31	80.30	0.013	-4.81	0.629	-171.50
600 MHz	0.935	-173.48	6.08	76.43	0.013	-7.68	0.635	-171.81
700 MHz	0.936	-175.34	5.20	72.85	0.013	-10.25	0.642	-171.96
800 MHz	0.937	-176.87	4.54	69.47	0.013	-12.62	0.649	-172.04
900 MHz	0.937	-178.19	4.03	66.24	0.013	-14.82	0.656	-172.11
1.0 GHz	0.938	-179.38	3.62	63.13	0.013	-16.89	0.664	-172.18
1.1 GHz	0.939	179.54	3.28	60.12	0.013	-18.84	0.672	-172.28
1.2 GHz	0.939	178.52	3.00	57.20	0.012	-20.69	0.680	-172.42
1.3 GHz	0.940	177.55	2.77	54.36	0.012	-22.44	0.688	-172.60
1.4 GHz	0.941	176.60	2.57	51.59	0.012	-24.10	0.695	-172.83
1.5 GHz	0.942	175.68	2.39	48.89	0.012	-25.67	0.703	-173.11
1.6 GHz	0.942	174.77	2.24	46.24	0.012	-27.15	0.710	-173.42
1.7 GHz	0.943	173.87	2.11	43.66	0.012	-28.56	0.718	-173.78
1.8 GHz	0.943	172.96	2.00	41.12	0.011	-29.88	0.724	-174.18
1.9 GHz	0.944	172.04	1.90	38.63	0.011	-31.12	0.731	-174.61
2.0 GHz	0.944	171.11	1.81	36.19	0.011	-32.29	0.737	-175.07
2.1 GHz	0.944	170.16	1.73	33.78	0.011	-33.39	0.743	-175.57
2.2 GHz	0.944	169.19	1.67	31.41	0.011	-34.42	0.748	-176.10
2.3 GHz	0.945	168.19	1.61	29.06	0.011	-35.38	0.753	-176.65
2.4 GHz	0.944	167.16	1.55	26.74	0.010	-36.28	0.758	-177.23
2.5 GHz	0.944	166.10	1.51	24.43	0.010	-37.11	0.762	-177.83
2.6 GHz	0.944	165.00	1.47	22.14	0.010	-37.88	0.765	-178.45
2.7 GHz	0.944	163.85	1.43	19.85	0.010	-38.60	0.769	-179.10
2.8 GHz	0.943	162.64	1.41	17.56	0.010	-39.27	0.771	-179.77
2.9 GHz	0.942	161.38	1.38	15.27	0.010	-39.90	0.774	179.54
3.0 GHz	0.941	160.06	1.36	12.96	0.010	-40.48	0.776	178.82
3.2 GHz	0.939	157.18	1.34	8.27	0.010	-41.54	0.778	177.32
3.4 GHz	0.935	153.93	1.33	3.43	0.010	-42.52	0.779	175.73
3.6 GHz	0.931	150.21	1.34	-1.65	0.010	-43.50	0.778	174.01
3.8 GHz	0.925	145.88	1.37	-7.06	0.010	-44.60	0.774	172.17
4.0 GHz	0.916	140.74	1.43	-12.95	0.011	-45.95	0.769	170.17
4.2 GHz	0.906	134.55	1.50	-19.47	0.011	-47.77	0.760	167.98
4.4 GHz	0.891	126.90	1.61	-26.85	0.012	-50.32	0.749	165.56
4.6 GHz	0.872	117.26	1.75	-35.39	0.013	-53.96	0.733	162.84
4.8 GHz	0.848	104.85	1.92	-45.48	0.014	-59.15	0.713	159.74
5.0 GHz	0.817	88.57	2.14	-57.60	0.016	-66.44	0.688	156.11
5.2 GHz	0.784	67.16	2.37	-72.25	0.018	-76.37	0.654	151.74
5.4 GHz	0.759	39.85	2.58	-89.71	0.020	-89.30	0.609	146.35
5.6 GHz	0.757	8.00	2.70	-109.65	0.021	-104.92	0.546	139.55
5.8 GHz	0.788	-24.14	2.67	-130.98	0.022	-122.14	0.460	130.98
6.0 GHz	0.836	-52.18	2.49	-152.33	0.021	-139.60	0.347	119.94

Download this s-parameter file in ".s2p" format at http://www.cree.com/products/wireless_s-parameters.asp

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Product Dimensions CGH27060F (Package Type — 440193)



NOTES:

1. DIMENSIONING AND TOLERANICING 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	0.225	0.235	5.72	5.97
B	0.004	0.006	0.10	0.15
C	0.145	0.165	3.68	4.19
D	0.077	0.087	1.96	2.21
E	0.355	0.365	9.02	9.27
F	0.210	0.220	5.33	5.59
G	0.795	0.805	20.19	20.45
H	0.670	0.730	17.02	18.54
J	ø .130		3.30	
k	0.562		14.28	

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

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
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For more information, please contact:

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
www.cree.com/rf

Sarah Miller
Marketing & Export
Cree, RF Components
1.919.407.5302

Ryan Baker
Marketing
Cree, RF Components
1.919.407.7816

Tom Dekker
Sales Director
Cree, RF Components
1.919.407.5639

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf