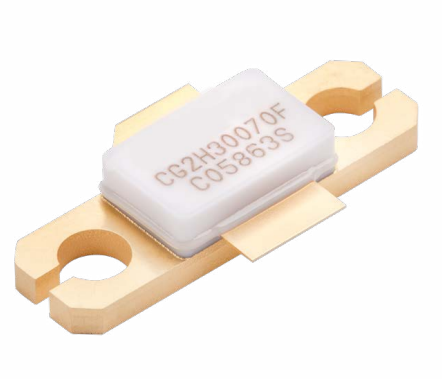
CG2H30070F

70 W, DC - 4.0 GHz, 28 V, RF Power GaN HEMT



Package Types: 440224
PN's: CG2H30070F

Description

The CG2H30070F is an internally matched gallium nitride (GaN) high electron mobility transistor (HEMT). The CG2H30070F, operating from a 28 volt rail, offers a general purpose, broadband solution to a variety of RF and microwave applications. GaN HEMTs offer high efficiency, high gain and wide bandwidth capabilities making the CG2H30070F ideal for linear and compressed amplifier circuits. The transistor is available in a flange package.

Features

- 0.5 - 3.0 GHz application circuit
- 85 W P_{OUT} typical at 28 V
- 10 dB power gain
- 58% drain efficiency
- Internally matched

Applications

- Broadband amplifiers
- Electronic counter measures
- Signal jamming
- Milcom
- Radar
- Data link

Typical Performance Over 0.5 - 3.0 GHz (T_C = 25 °C)

Parameter	500 MHz	1000 MHz	1500 MHz	2000 MHz	2500 MHz	3000 MHz	Units
Small Signal Gain (S21)	16.7	15.3	17.3	15	16.3	14.8	dB
Gain @ P_{IN} = 39 dBm	10.3	10.4	10.6	9.8	11.4	10.5	dB
Output Power @ P_{IN} = 39 dBm	85	88	90	76	109	89	W
Efficiency @ P_{IN} = 39 dBm	63	57.5	55.6	63.4	62.1	59.8	%

Notes:
Operating conditions are CW

Large Signal Models Available for ADS and MWO

RoHS compliant

Rev. 3.3, OCTOBER 2023

Absolute Maximum Ratings (Not Simultaneous) at 25 °C Case Temperature

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DSS}	120	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}	28.8	mA	25 °C
Maximum Drain Current[1]	I_{DMAX}	12	A	25 °C
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, CW, P_{DISS} = 115 W
Case Operating Temperature[2]	T_C	-40, +150	°C	

Notes:
[1] Current limit for long-term, reliable operation.
[2] Refer to the Application Note on soldering
[3] See also, the power dissipation de-rating curve on Page 8.

Electrical Characteristics (T_C = 25 °C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1]						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-2.8	-2.3	V_{DC}	V_{DS} = 10 V, I_D = 28.8 mA
Saturated Drain Current[2]	I_{DS}	20.7	28.8	–	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[3] (T_C = 25 °C, F_0 = 3000 MHz Unless Otherwise Noted)						
Small Signal Gain	G_{SS}	15.6	17.7	–	dB	V_{DD} = 28 V, I_{DQ} = 1.0 A, P_{IN} = 10 dBm, CW
Power Gain	G_P	–	12	–	dB	V_{DD} = 28 V, I_{DQ} = 1.0 A, P_{IN} = 38 dBm, CW
Output Power	P_{OUT}	48.25	50	–	dBm	V_{DD} = 28 V, I_{DQ} = 1.0 A, P_{IN} = 38 dBm, CW
Drain Efficiency[4]	η	61	71	–		V_{DD} = 28 V, I_{DQ} = 1.0 A, P_{IN} = 38 dBm, CW
Output Mismatch Stress	VSWR	–	–	5 : 1	Ψ	No Damage at All Phase Angles, V_{DD} = 28 V, I_{DQ} = 1.0 A, P_{OUT} = 100 W CW
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	68.1	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	11.3	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	1.49	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz

Notes:
[1] Measured on wafer prior to packaging per side of device.
[2] Scaled from PCM data.
[3] Measurements are to be performed using the production test fixture AD-838279F-TB (Flange).
[4] Drain Efficiency = P_{OUT}/P_{DC}.

CG2H30070F Typical Performance

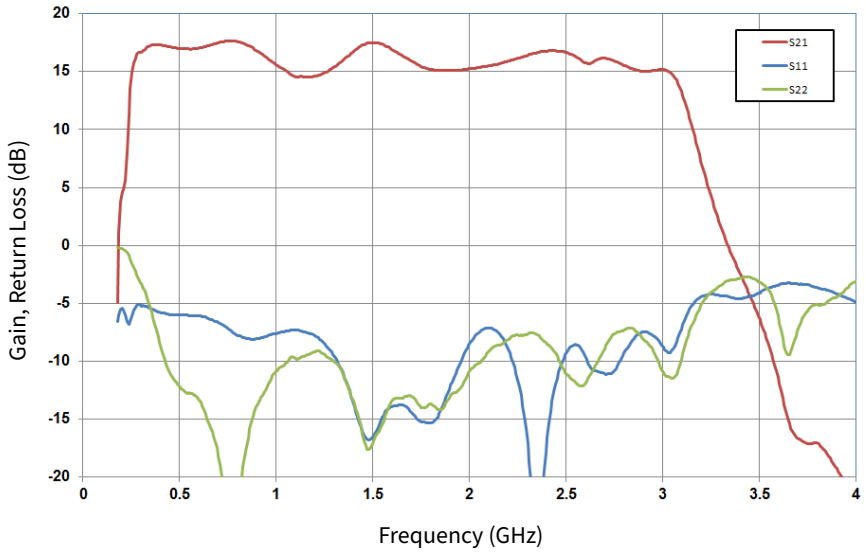


Figure 1. Small Signal Gain and Return Losses of the CG2H30070F vs Frequency as Measured in the Single-ended Demonstration Amplifier CG2H30070F-AMP
V_{DD} = 28 V, I_{DQ} = 1.0 A

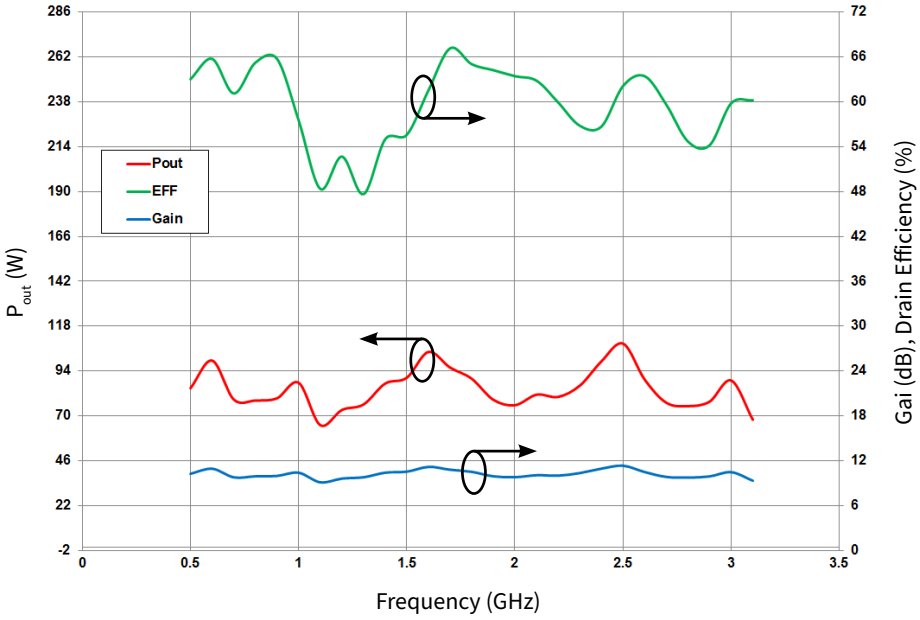


Figure 2. Output Power and Efficiency of the CG2H30070F vs Frequency as Measured in the Single-ended Demonstration Amplifier CG2H30070F-AMP
CW Operation, V_{DD} = 28 V, I_{DQ} = 1.0 A, P_{IN} = 39 dBm

CG2H30070F Typical Performance

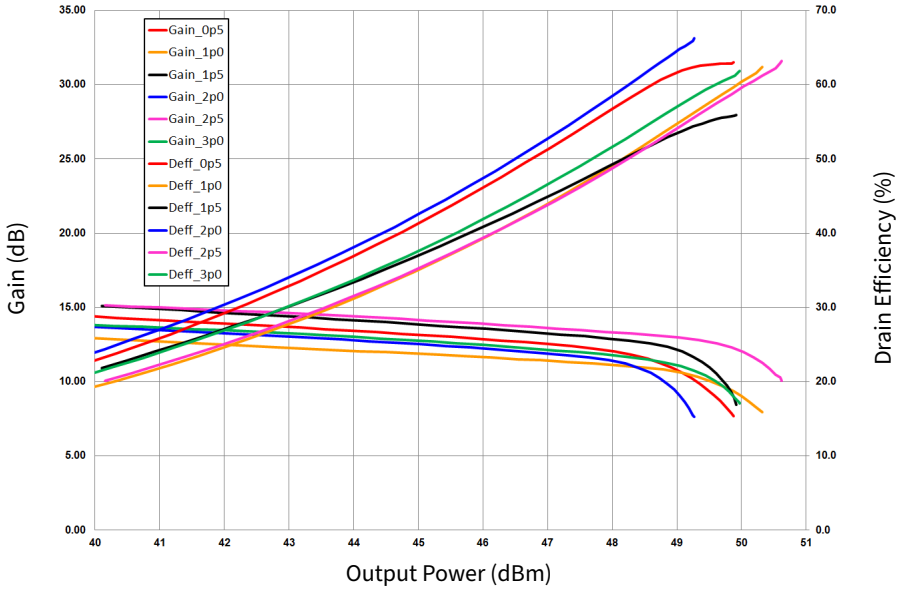


Figure 3. Gain and Drain Efficiency vs Output Power at Various Frequencies as Measured in the Single-ended Demonstration Amplifier CG2H30070F-AMP CW-Operation, V_{DD} = 28 V, I_{DQ} = 1.0 A

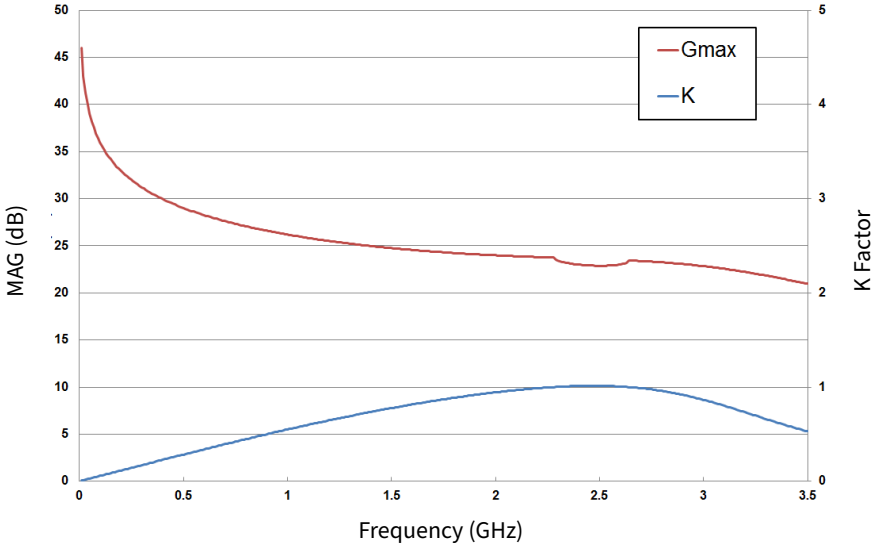


Figure 4. Simulated Maximum Available Gain and K-factor of the CG2H30070F V_{DD} = 28 V, I_{DQ} = 1.0 A

CG2H30070F Typical Performance

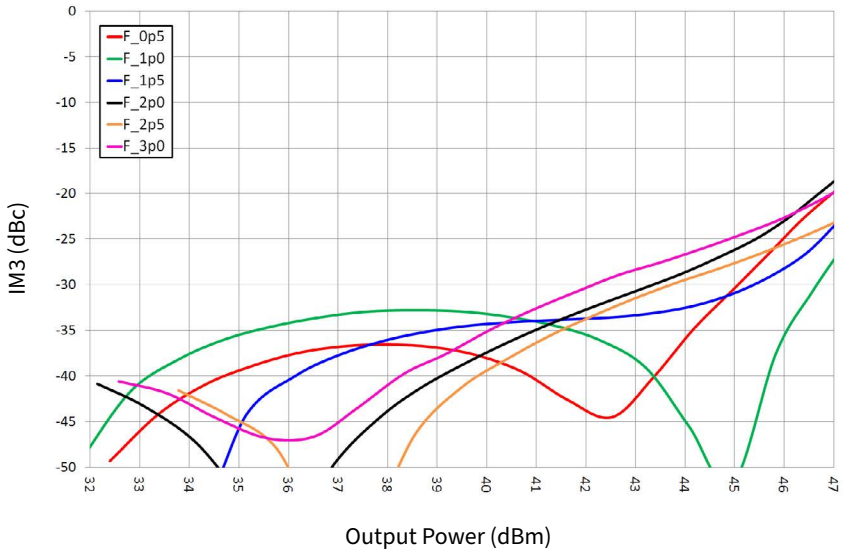


Figure 5. IM3 vs Output Power of the CG2H30070F as Measured in the Single-ended Demonstration Amplifier CG2H30070F-AMP
I_{DQ} = 300 mA, Temperature = 25 °C

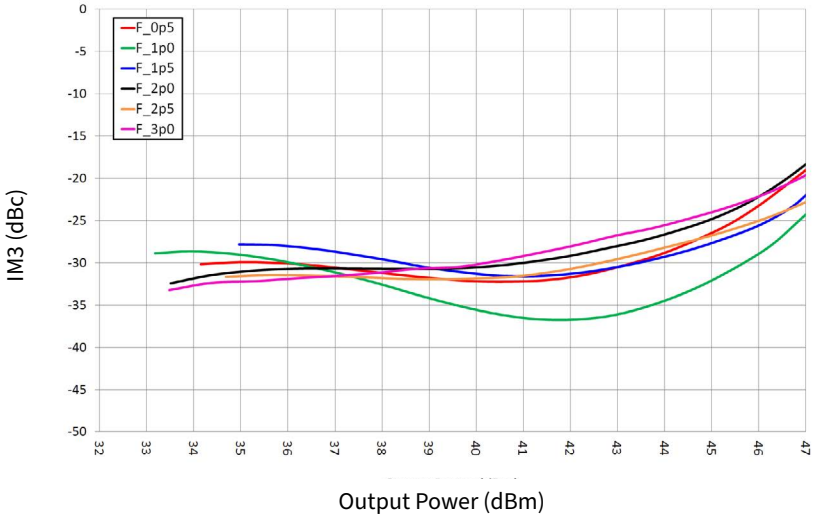


Figure 6. IM3 vs Output Power of the CG2H30070F as Measured in the Single-ended Demonstration Amplifier CG2H30070F-AMP
I_{DQ} = 1000 mA, Temperature = 25 °C

CG2H30070F Typical Performance

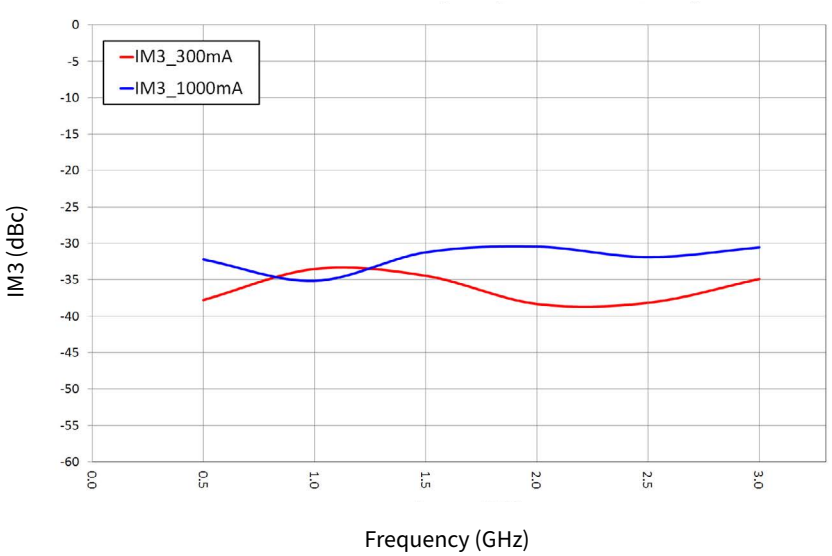
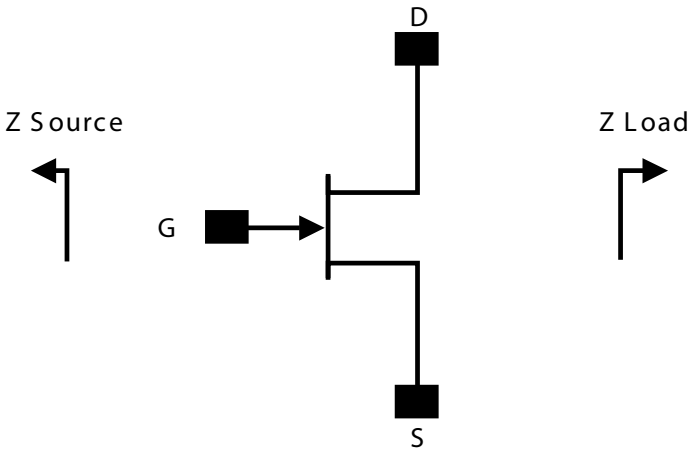


Figure 7. IM3 vs Frequency of the CG2H30070F as Measured in the Single-ended Demonstration Amplifier CG2H30070F-AMP
P_{OUT} = 40 dBm, Temperature = 25 °C

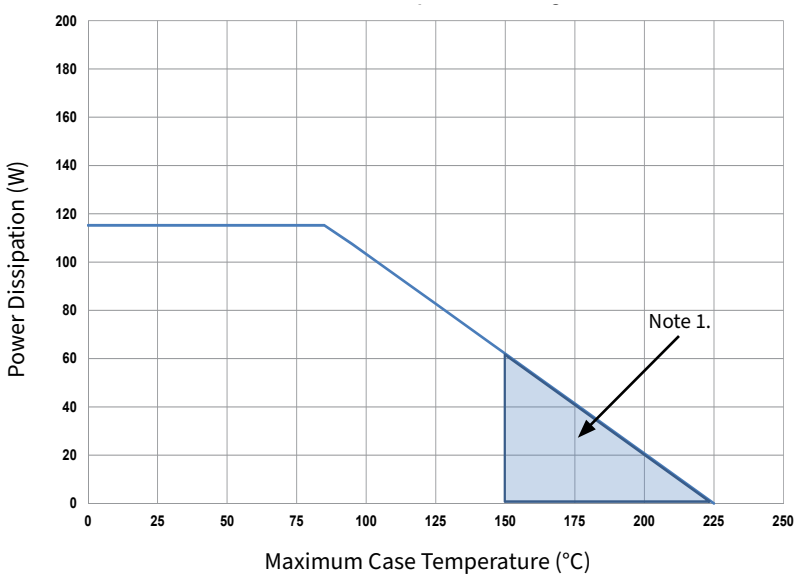
Simulated Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
500	9 - j5.15	5.79 - j2.56
1000	7.45 - j3.82	4.76 - j1.35
1500	1.7 - j3.24	3.55 + j0.8
2000	2.33 - j0.06	4.19 + j0.19
2500	4.57 - j2.15	4.34 - j1.73
3000	1.07 - j1.04	2.65 - j1.57

Note 1. V_{DD} = 28 V, I_{DQ} = 1.0 A in the 440224 package.
Note 2. Optimized for power, gain, P_{SAT}, and drain efficiency.
Note 3. When using this device at low frequency, series resistors should be used to maintain amplifier stability.

CG2H30070F Power Dissipation De-Rating Curve, CW

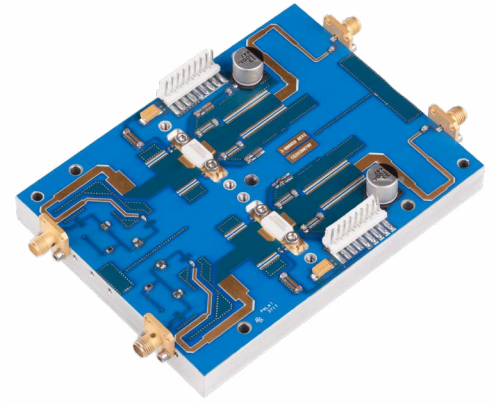


Note 1. Area exceeds maximum case operating temperature (see page 2).

Typical Combined Performance

The previous plots were created from one side of the wideband application circuit, CG2H30070F-AMP2 in order to demonstrate the RF performance of the transistor over a wide frequency band. The application circuit CG2H30070FAMP2 is designed to combine two CG2H30070F in order to achieve 100W CW from 0.5-3.0 GHz instantaneously. Figure 8 shows the typical RF performance from CG2H30070F-AMP2.

To achieve this performance, couplers from Innovative Power Products were used. The IPP-2256 uses N-type connectors in order to handle the higher output power from this application circuit and lead to the reason for the spacing seen in the SMA connectors in the application amplifier CG2H30070F-AMP2.



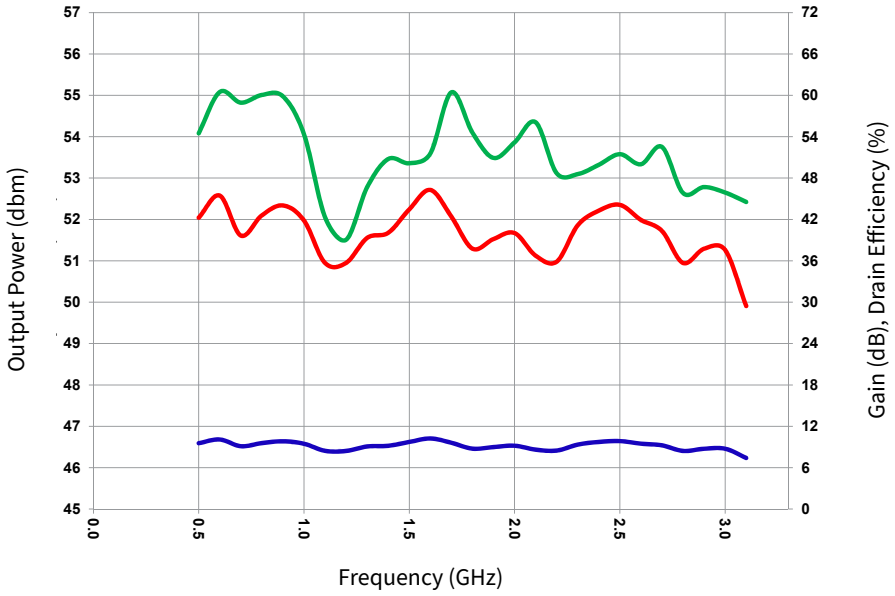
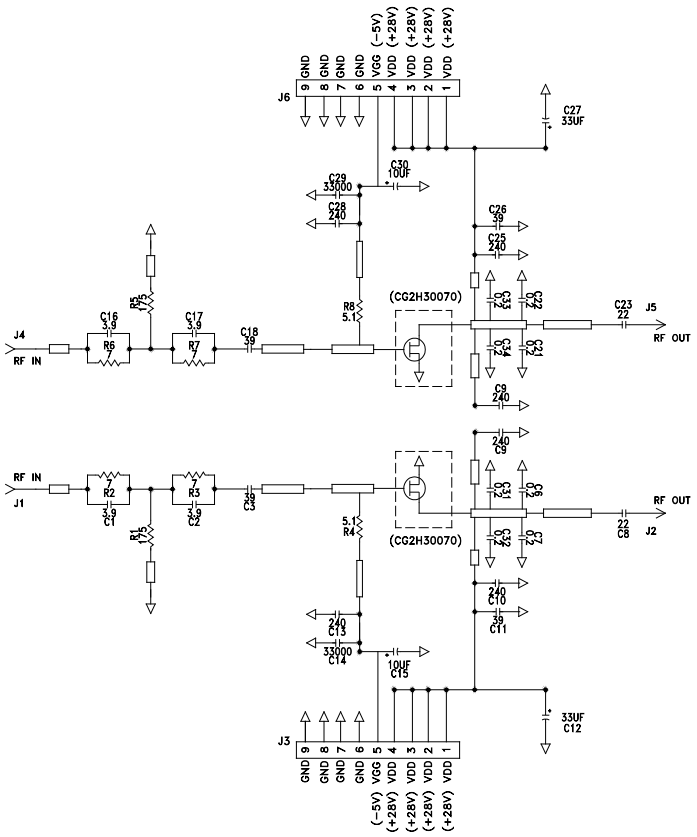
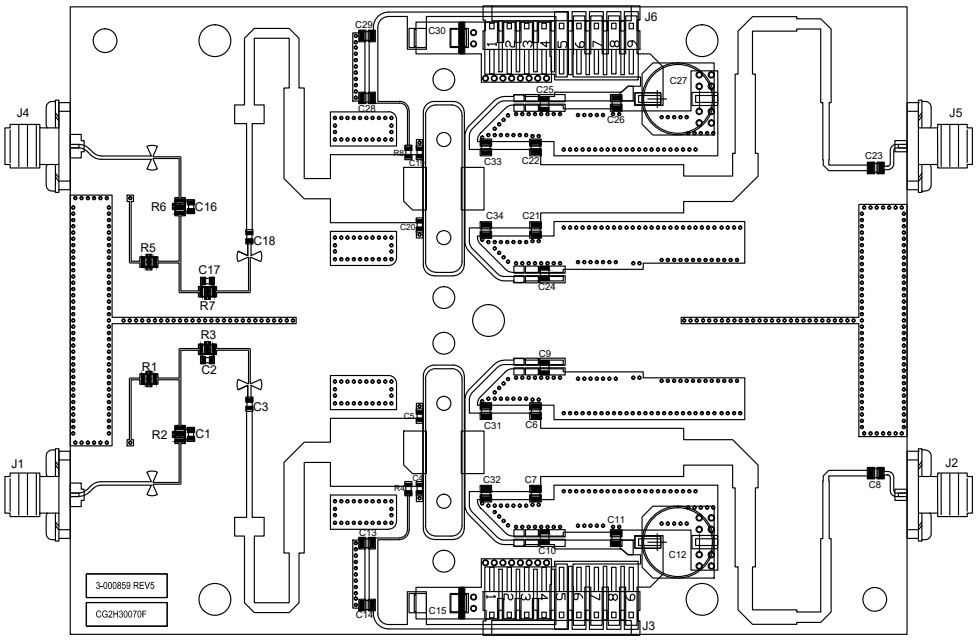


Figure 8. Output Power, Power Gain, and Drain Efficiency vs Frequency of Two CG2H30070F Combined as Measured in the Combined Demonstration Amplifier CG2H30070F-AMP2 with Couplers
V_{DD} = 28 V, I_{DQ} = 2 A, P_{IN} = 42.5 dBm, Temperature = 25 °C

CG2H30070F-AMP2 Demonstration Amplifier Circuit Schematic



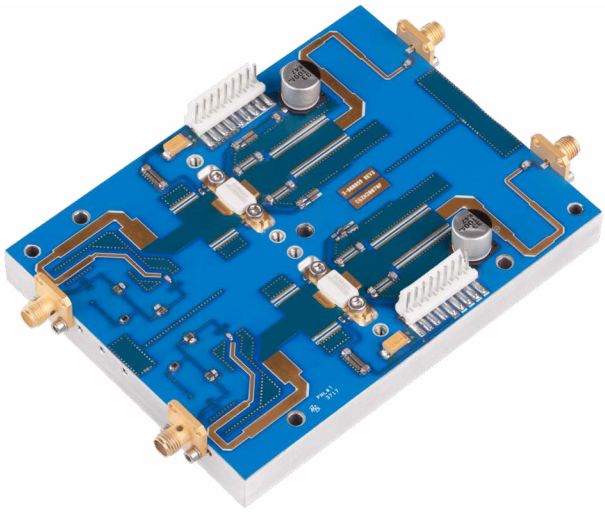
CG2H30070F-AMP2 Demonstration Application Circuit Outline



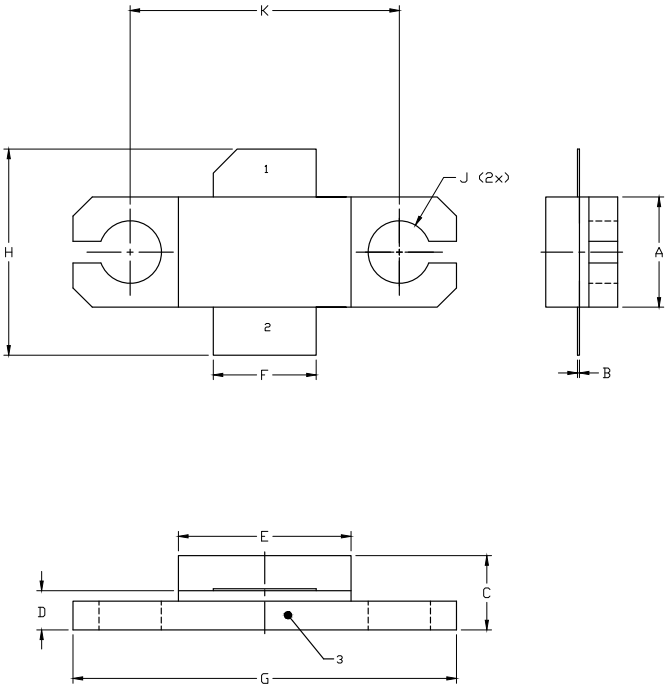
CG2H30070F-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
C11, C26	CAP, 39 pF, ±5%, 250 V, 0805, ATC600F	2
C8, C23	CAP, 22 pF, ±5%, 250 V, 0805, ATC600F	2
C3, C18	CAP, 39 pF, ±5%, 0603, ATC	2
C14, C29	CAP, 33000 PF, 0805, 100 V, X7R	2
C15, C30	CAP, 10 UF, 16 V TANTALUM	2
C13, C9, C10, C28, C24, C25	CAP, 240 pF, ±5%, 250 V, 0805, ATC600F	6
C6, C7, C31, C32, C21, C22, C33, C34	CAP, 0.2 pF, ±0.05% pF, 250 V, 0805, ATC600F	8
C1, C2, C16, C17	CAP, 3.9 pF, ±0.1 pF, 0603, ATC	4
R2, R3, R6, R7	RES, 7 OHM, 0805, HIGH POWER SMT, IMS	4
R1, R5	RES, 175 OHM, 0805, HIGH POWER SMT, IMS	2
R4, R8	RES, 5 OHM, 0603, SMT	2
C12, C27	CAP, 33 UF, 20%, 100 V, ELEC	2
J1, J2, J4, J5	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20 MIL	4
J3, J6	HEADER RT>PLZ .1CEN LK 9POS	2
	PCB, RO6035HTC, 3.6” x 4.8” x 0.010”, CG2H30070F	1
	BASEPLATE, Al, 4.8 x 3.6 x 0.5	

CG2H30070F-AMP2 Demonstration Amplifier Circuit



Product Dimensions CG2H30070F (Package Type — 440224)



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.

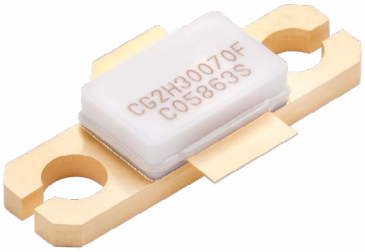
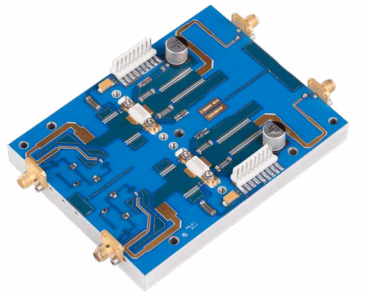
4. LID MAY BE MISALIGNED TO THE BODY OF THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

5. ALL PLATED SURFACES ARE NI/AU

	INCHES		MILLIMETERS	
DIM	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	0.400	0.460	10.16	11.68
J	ø .130		3.30	
k	0.562		14.27	

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

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CG2H30070F	GaN HEMT	Each	
CG2H30070F-AMP2	Test board with GaN HEMT installed	Each	

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