CGHV59070

70 W, 4.4 - 5.9 GHz, 50 V, RF Power GaN HEMT

Description

Wolfspeed's CGHV59070 is an internally matched gallium nitride (GaN) high electron mobility transistor (HEMT). The CGHV59070, operating from a 50 volt rail, offers a general purpose, broadband solution to a variety of RF and microwave applications. The good efficiency, high gain and wide bandwidth capabilities make the CGHV59070 ideal for linear applications such as wireless infrastructure and for compressed amplifier circuits. The transistor is available in a flange and pill package.

Package Type: 440224, 440170
PN's: CGHV59070F, CGHV59070P

Features

- 4.4 - 5.9 GHz Operation
- 90 W P_{OUT} typical at 50 V
- 14 dB Power Gain
- 55% Drain Efficiency
- Internally Matched

Applications

- Wireless Infrastructure
- Marine Radar
- Weather Monitoring
- Air Traffic Control
- Maritime Vessel Traffic Control
- Port Security
- Troposcatter Communications
- Beyond Line of Sight - BLOS

Typical Performance Over 4.8 - 5.9 GHz (T_C = 25˚C)

Parameter	4.8 GHz	5.0 GHz	5.2 GHz	5.4 GHz	5.6 GHz	5.8 GHz	5.9 GHz	Units
Power Gain at 50 V	13.7	14.2	14.5	14.6	14.3	13.7	13.3	dB
Output Power at 50 V	84	93	101	102	95	84	76	W
Drain Efficiency at 50 V	55	56	57	56	54	50	48	%

Notes:
[1] Measured in CGHV59070F-AMP (838269) under 100µs pulse width, 10% duty cycle, P_{IN} = 35.5 dBm (3.5 W)

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}	150	V	25°C
Gate-to-Source Voltage	V_{GS}	-10, +2		
Storage Temperature	T_{STG}	-65, +150	°C	
Operating Junction Temperature	T_J	225		
Maximum Forward Gate Current	I_{GMAX}	10.4	mA	25°C
Maximum Drain Current[1]	I_{DMAX}	6.3	A	
Soldering Temperature[2]	T_S	245	°C	
Screw Torque	τ	40	in-oz	
Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	2.99	°C/W	85°C , CW @ P_{DISS} = 57 W
Thermal Resistance, Junction to Case[3]		0.85		85°C, 100µs, 10% Duty Cycle @ P_{DISS} = 70 W
Case Operating Temperature[4]	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 CGHV59070F at P_{DISS} = 57.6 CW or P_{DISS} = 70 W Pulsed
[4] 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 = 10.4 mA
Saturated Drain Current[2]	I_{DS}	6.8	9.7	—	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BR}	125	—	—	V_{DC}	V_{GS} = -8 V, I_D = 10.4 mA
RF Characteristics[3] (T_C = 25°C, F_0 = 5.2 - 5.9 GHz unless otherwise noted)						
Small Signal Gain at 5.2 GHz	G_{SS}	15.55	17	—	dB	V_{DD} = 50 V, I_{DQ} = 0.15 A, P_{IN} = 10 dBm
Output Power at 5.2 GHz	P_{OUT}	75.9	100	—	W	V_{DD} = 50 V, I_{DQ} = 0.15 A, P_{IN} = 35.5 dBm
Output Power at 5.55 GHz				—		
Output Power at 5.9 GHz		62.4	77	—		
Drain Efficiency at 5.2 GHz	η	50	55	—	%	
Drain Efficiency at 5.55 GHz		46	54	—		
Drain Efficiency at 5.9 GHz		40	48	—		
Power Gain at 5.2 GHz	G_P	—	14.5	—	dB	
Output Mismatch Stress	VSWR	—	—	5 : 1	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 0.15 A, P_{IN} = 35.5 dBm Pulsed
Dynamic Characteristics						
Input Capacitance	C_{GS}	—	36	—	pF	V_{DS} = 50 V, V_{GS} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	—	109	—		
Feedback Capacitance	C_{GD}	—	0.26	—		

Notes:
[1] Measured on wafer prior to packaging
[2] Scaled from PCM data
[3] Measured in CGHV59070F-AMP
[4] Drain Efficiency = P_{OUT}/P_{DC}

Typical Performance

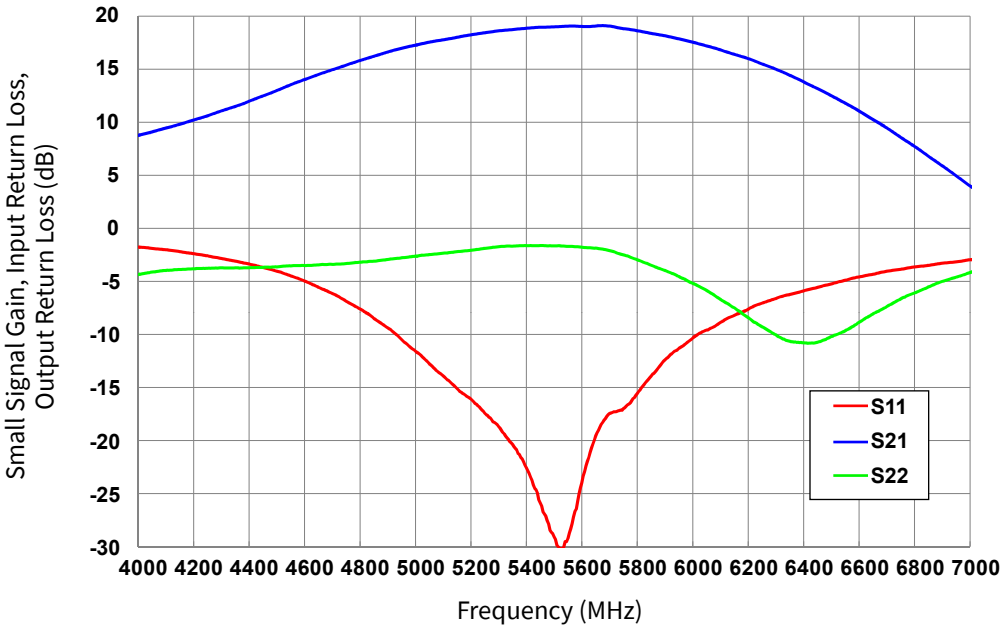


Figure 1. Small Signal Gain and Return Losses of the CGHV59070-AMP vs Frequency
V_{DD} = 50 V, I_{DQ} = 150 mA

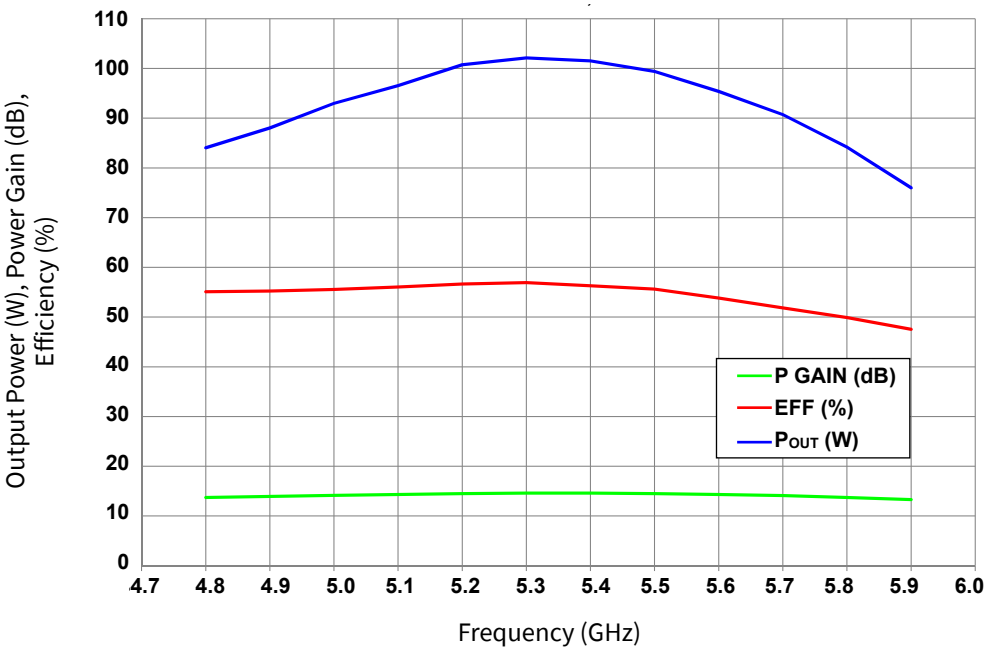


Figure 2. Power Gain, Drain Efficiency, and Output Power vs Frequency measured in Amplifier Circuit CGHV59070P-AMP
V_{DD} = 50 V, I_{DQ} = 150 mA, P_{IN} = 35.5 dBm, Pulse Width = 100µsec, Duty Cycle = 10%

Typical Performance

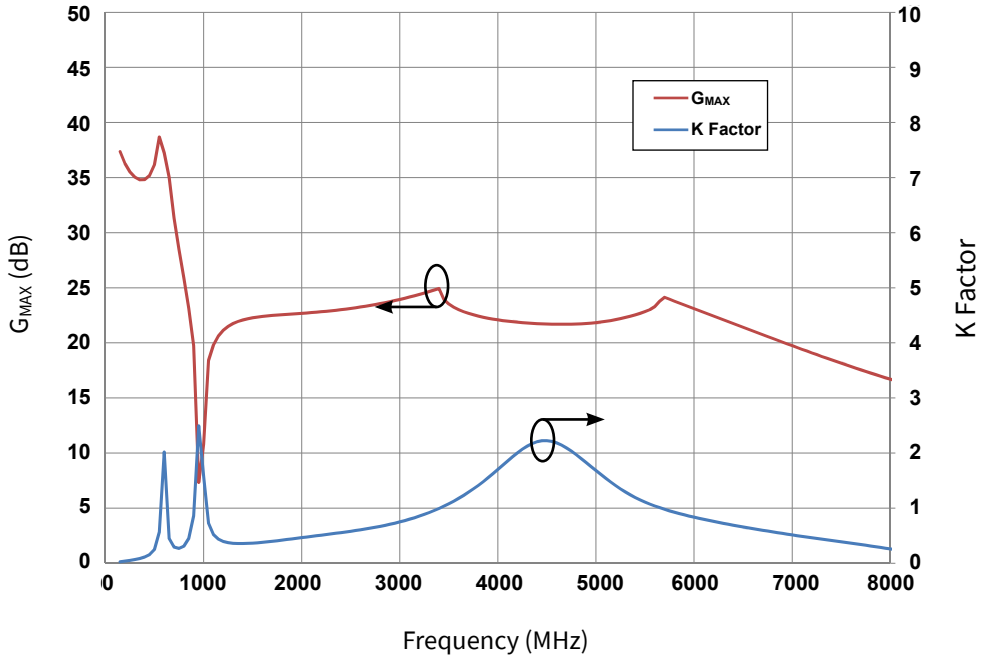


Figure3. Maximum Available Gain and K Factor of the CGHV59070
V_{DD} = 50 V, I_{DQ} = 150 mA

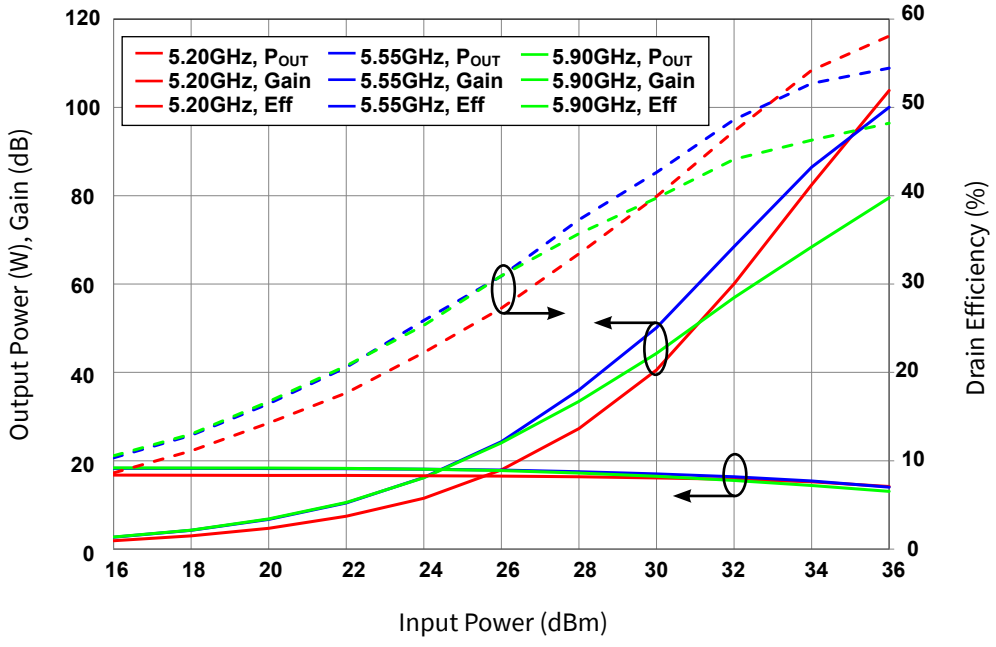


Figure 4. Power Gain, Drain Efficiency, and Output Power vs Input Power of the CGHV59070
V_{DD} = 50 V, I_{DQ} = 150 mA, Pulse Width = 100µsec, Duty Cycle = 10%

Typical Performance

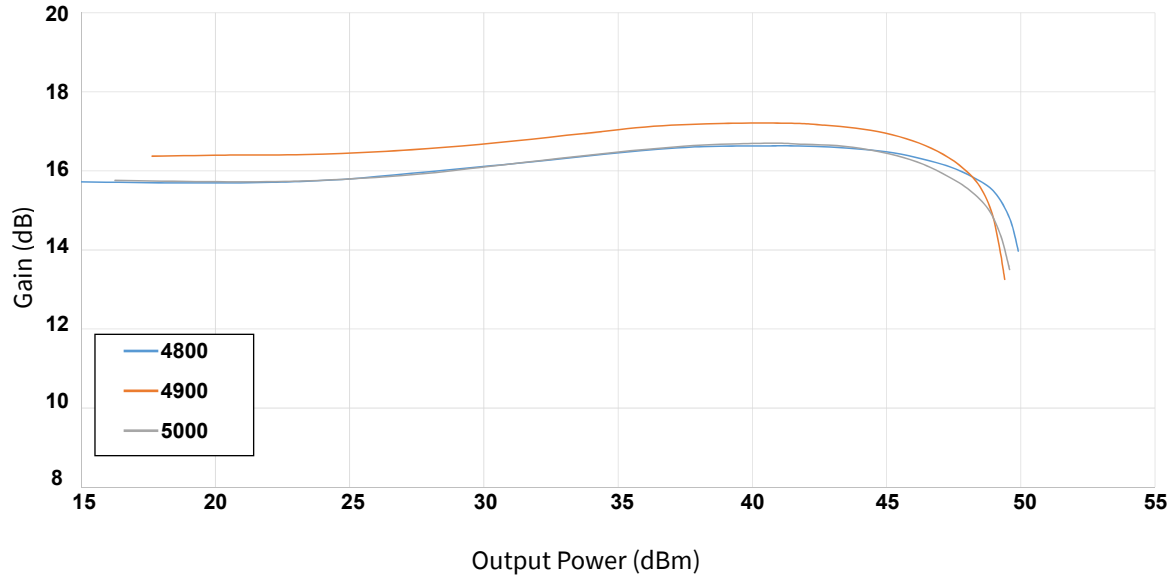


Figure 5. Gain vs Output Power Measured in CGHV59070F-AMP4
V_{DD} = 50 V, I_{DQ} = 75 mA

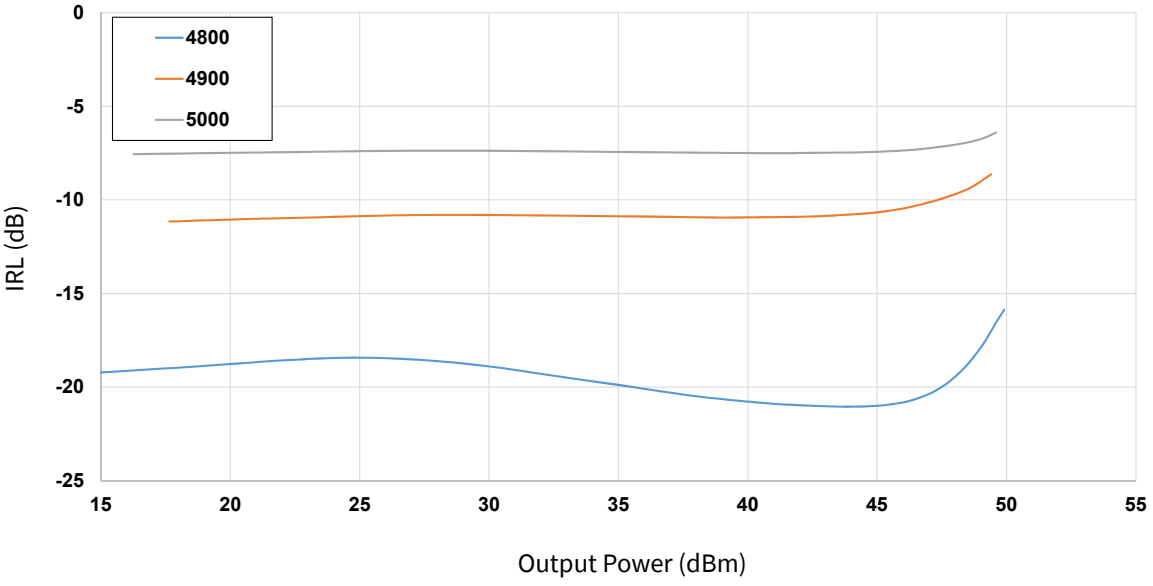


Figure 6. Input Return Loss vs Output Power Measured in CGHV59070F-AMP4
V_{DD} = 50 V, I_{DQ} = 75 mA

Typical Performance

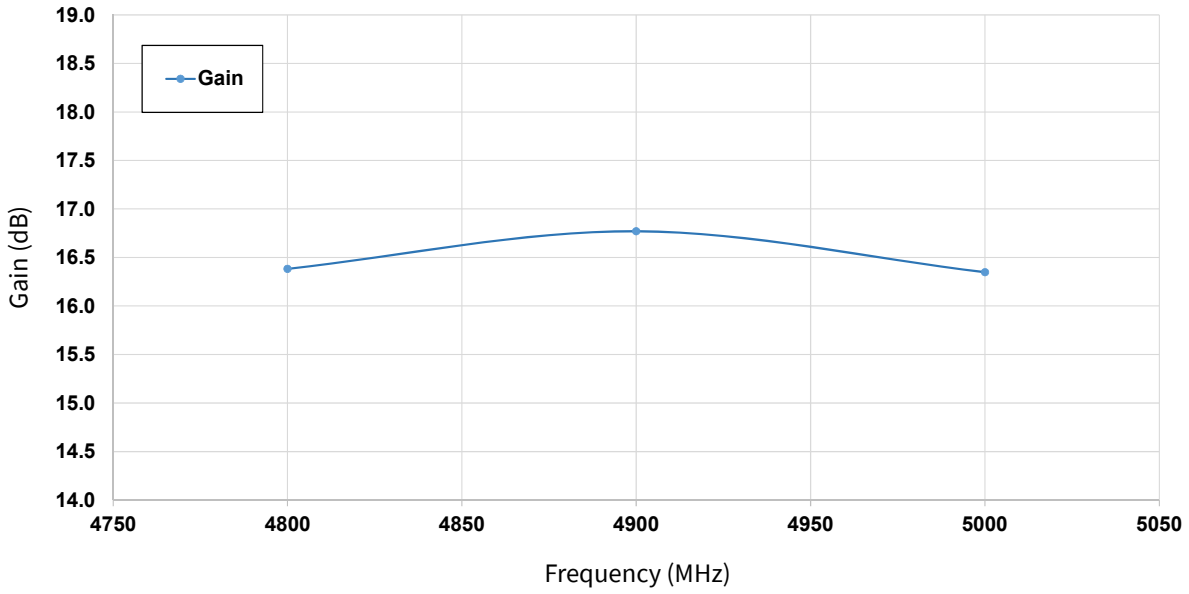


Figure 7. Gain vs Frequency Measured in CGHV59070F-AMP4
V_{DD} = 50 V, I_{DQ} = 75 mA, P_{OUT} = 42 dBm

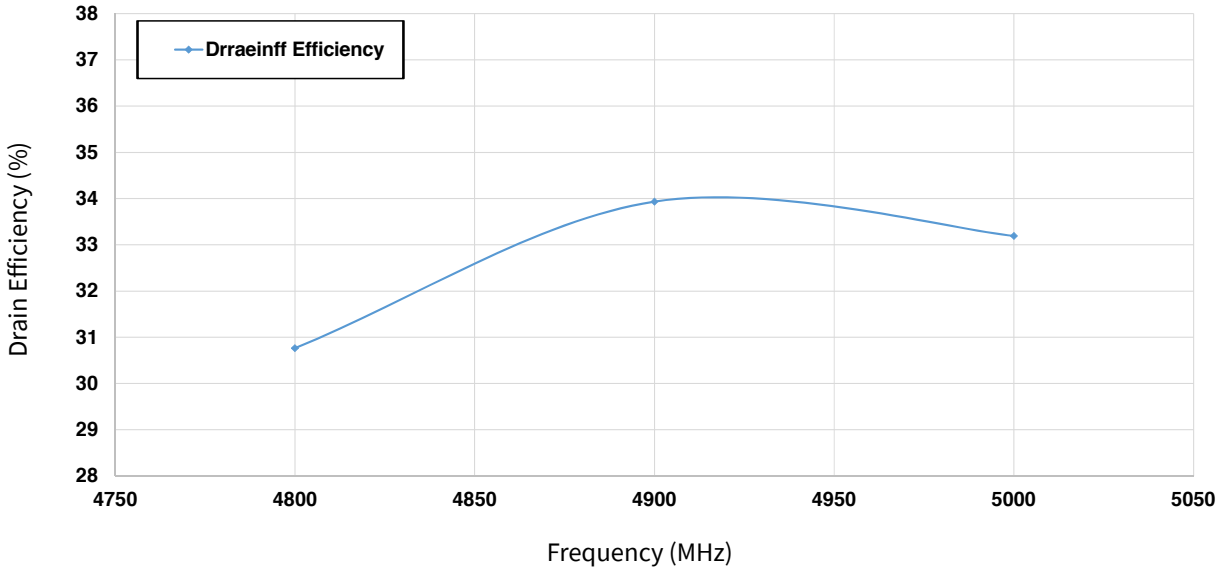


Figure 8. Drain Efficiency vs Frequency Measured in CGHV59070F-AMP4
V_{DD} = 50 V, I_{DQ} = 75 mA, P_{OUT} = 42 dBm

Typical Performance

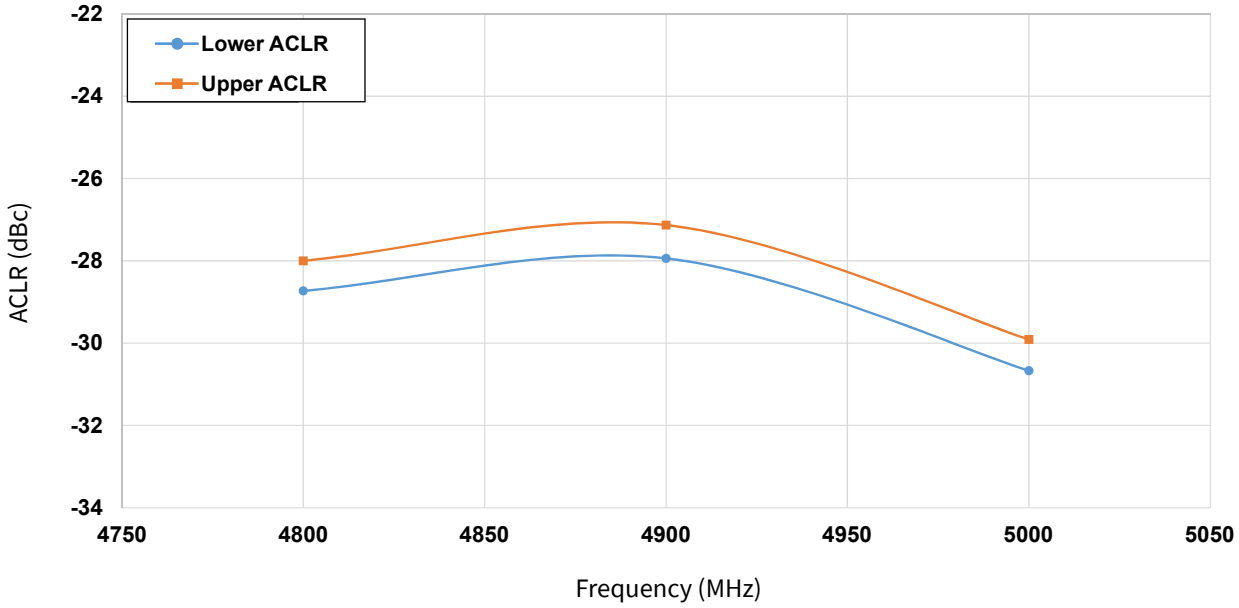
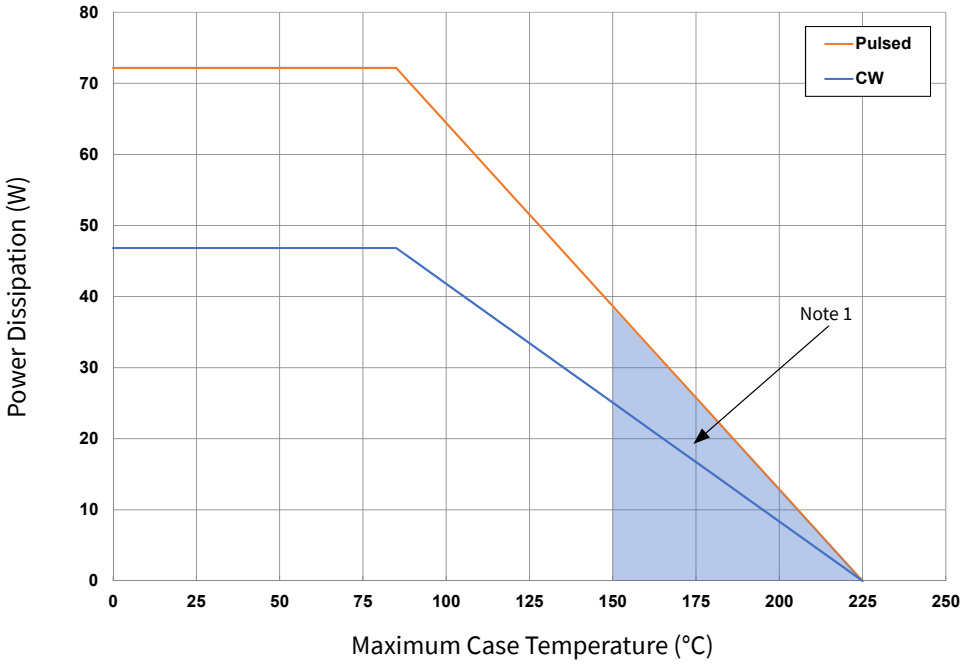


Figure 9. ACLR vs Frequency Measured in CGHV59070F-AMP4
V_{DD} = 50 V, I_{DQ} = 75 mA, P_{OUT} = 42 dBm, WCDMA 7.5 dB PAR Signal

Electrostatic Discharge (ESD) Classifications

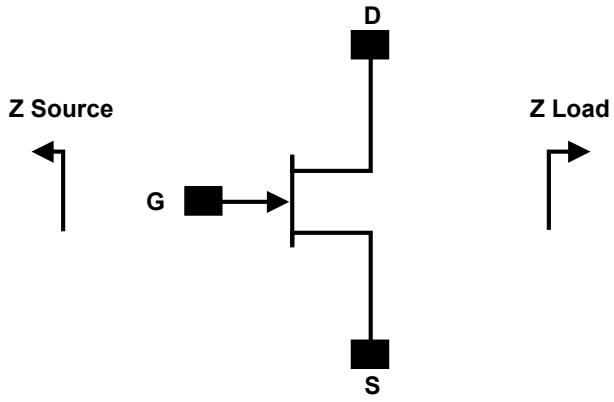
Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	1B	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	C3	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C

CGHV59070 Power Dissipation De-Rating Curve, Pulsed & CW (Pulsed Width = 100µs, Duty Cycle = 10%)



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

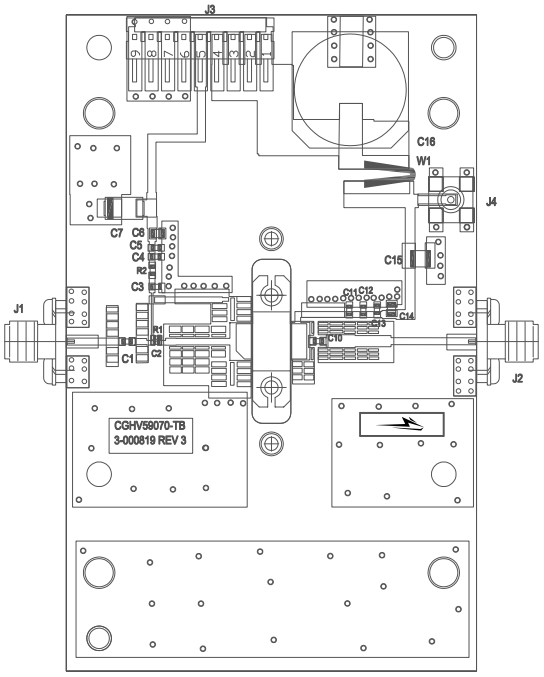
Simulated Source and Load Impedances



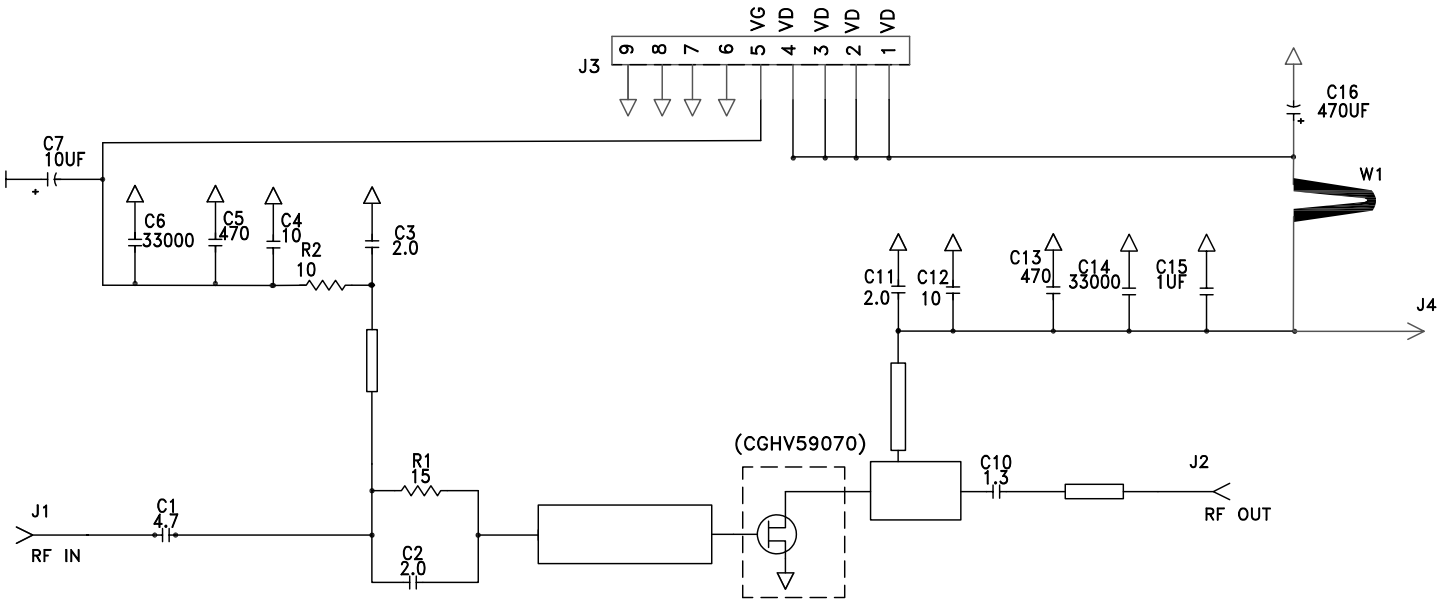
Frequency (MHz)	Z Source	Z Load
4400	2.6 - j12.9	14.0 - j6.9
4600	3.8 - j14.2	15.0 - j6.7
4800	5.8 - j15.3	16.0 - j7.0
5000	8.8 - j15.4	16.7 - j8.0
5200	8.8 - j14.7	17.1 - j9.1
5300	8.5 - j14.5	16.9 - j10.0
5400	8.1 - j14.2	16.5 - j10.7
5500	7.8 - j13.9	15.4 - j11.4
5600	7.5 - j13.6	15.4 - j12.0
5700	7.2 - j13.3	14.6 - j12.5
5800	6.9 - j13.3	13.8 - j12.8
5900	6.6 - j12.7	12.9 - j13.1

Notes:
[1] V_{DD} = 50 V, I_{DQ} = 150 mA in the 440224 package
[2] Optimized for power gain, P_{SAT} and PAE
[3] When using this device at low frequency, series resistors should be used to maintain amplifier stability

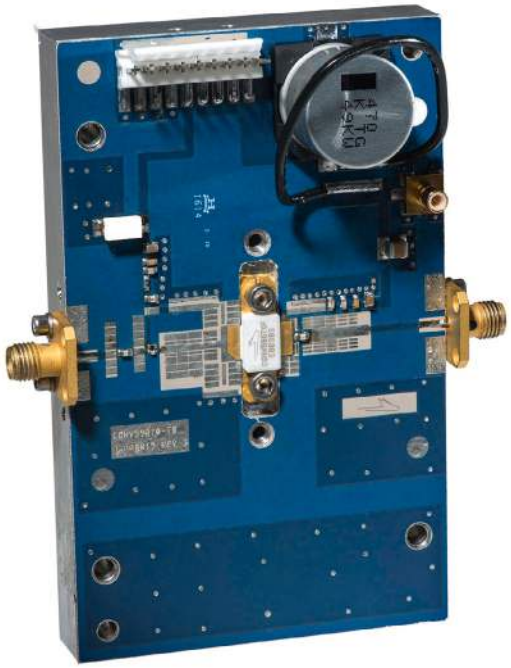
CGHV59070-AMP Demonstration Amplifier Circuit Outline



CGHV59070-AMP Demonstration Amplifier Circuit Schematic



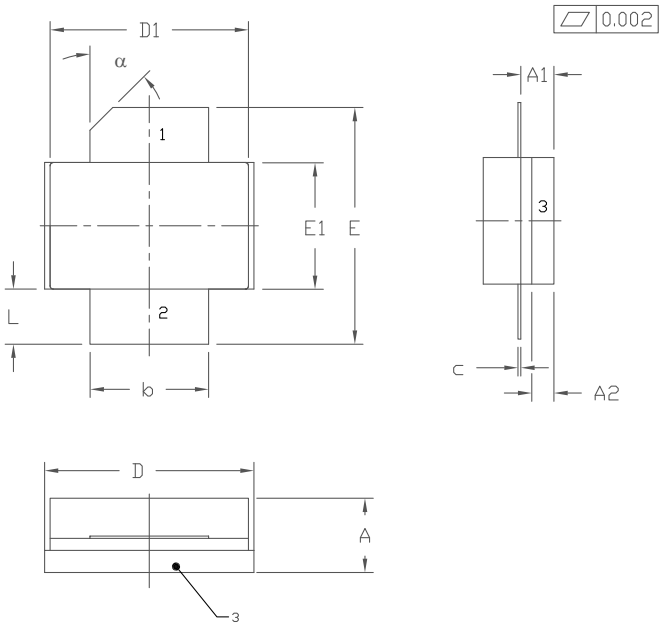
CGHV59070-AMP Demonstration Amplifier Circuit



CGHV59070-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 15, OHM, +/- 1%, 1/16W, 0402	1
R2	RES, 1/16W, 0603, 1%,10.0 OHMS	1
C1	CAP, 4.7pF, +/-0.1pF, 0603, ATC600S	1
C10	CAP, 1.3pF, +/-0.1pF, 0603, ATC600S	1
C3, C11	CAP, 2.0pF, +/-0.1pF, 0603, ATC600S	1
C2	CAP, 2.0pF, +/- 0.05pF, 0402, ATC600L	1
C4, C12	CAP, 10pF, +/-5%, 0603, ATC600S	2
C5, C13	CAP, 470pF, 5%, 100V, 0603, X	2
C6, C14	CAP, 33000pF, 0805, 100V, X7R	2
C15	CAP, 1.0µF, 100V, 10%, X7R, 1210	1
C7	CAP, 10µF 16V TANTALUM	1
W1	CABLE, 18 AWG, 4.2 inch	1
C16	CAP, 470µF, 20%, 80V, ELECT, SMD Size K	1
J1, J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
J4	CONNECTOR; SMB, Straight, JACK, SMD	1
—	Taconic RF-35, PCB, 20 mil	1
Q1	CGHV59070	1

Product Dimensions CGHV59070P (Package Type — 440170)



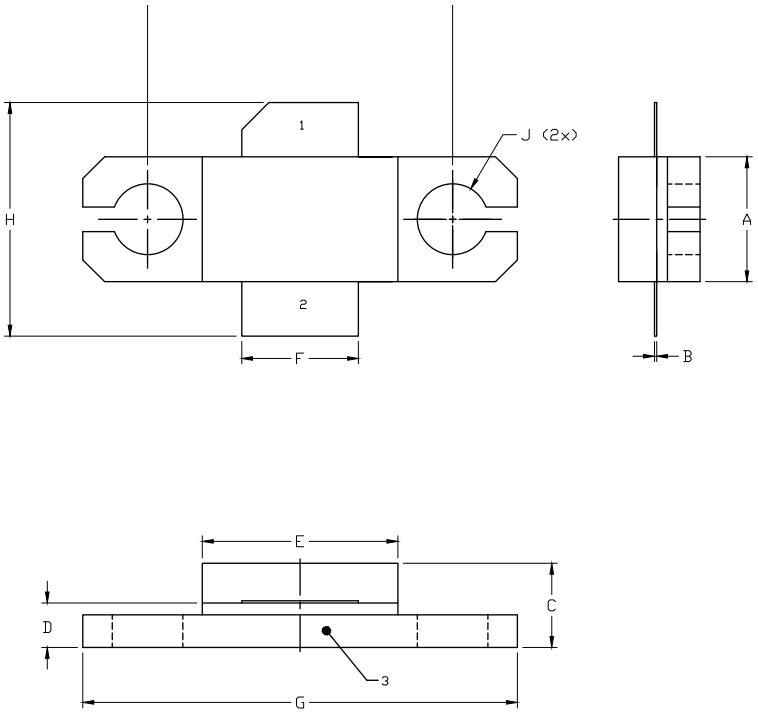
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M – 1994.
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 PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

	INCHES		MILLIMETERS		NOTES
DIM	MIN	MAX	MIN	MAX	
A	0.125	0.145	3.18	3.68	
A1	0.057	0.067	1.45	1.70	
A2	0.035	0.045	0.89	1.14	
b	0.210	0.220	5.33	5.59	2x
c	0.004	0.006	0.10	0.15	2x
D	0.375	0.385	9.53	9.78	
D1	0.355	0.365	9.02	9.27	
E	0.400	0.460	10.16	11.68	
E1	0.225	0.235	5.72	5.97	
L	0.085	0.115	2.16	2.92	2x
α	45° REF		45° REF		

PIN 1. GATE
2. DRAIN
3. SOURCE

Product Dimensions CGHV59070F (Package Type — 440224)



1982.

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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

Part Number System

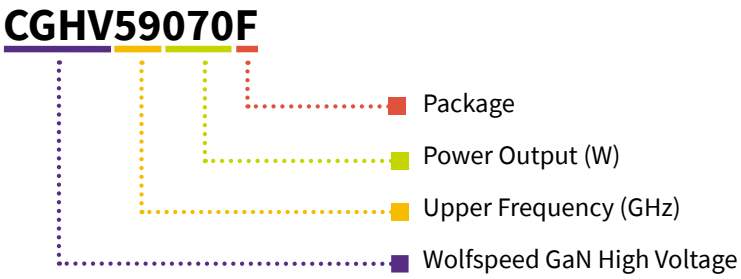

Table 1.

Parameter	Value	Units
Upper Frequency[1]	5.9	GHz
Power Output	70	W
Package	Flange/Pill	—

Note:
[1] Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

Table 2.

Character Code	Code Value
A	0
B	1
C	2
D	3
E	4
F	5
G	6
H	7
J	8
K	9
Examples:	1A = 10.0 GHz 2H = 27.0 GHz

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV59070F	GaN HEMT	Each	
CGH59070P	GaN HEMT	Each	
CGHV59070F-AMP	Test board with GaN HEMT installed	Each	

For more information, please contact:

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Notes & Disclaimer

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