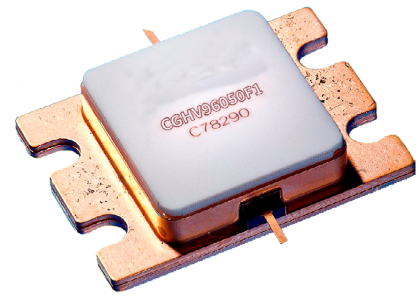
CGHV96050F1

50 W, 7.9 - 9.6 GHz, 50-ohm, Input/Output Matched GaN Amplifier



PN: CGHV96050F1
Package Type: 440217

Description

The CGHV96050F1 is a gallium nitride (GaN) amplifier. This GaN Internally Matched (IM) FET offers excellent power added efficiency in comparison to other technologies. GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity and higher thermal conductivity. GaN HEMTs also offer greater power density and wider bandwidths compared to GaAs transistors. This amplifier is available in a metal/ceramic flanged package for optimal electrical and thermal performance.

Features

- 7.9 - 8.4 GHz Operation
- 80 W P_{OUT} typical
- >13 dB Power Gain
- 33% Typical PAE
- 50 Ohm Internally Matched
- <0.1 dB Power Droop

Applications

- Satellite Communications
- Terrestrial Broadband

Typical Performance Over 7.9 - 8.4 GHz (T_C = 25˚C)

Parameter	7.9 GHz	8.0 GHz	8.1 GHz	8.2 GHz	8.3 GHz	8.4 GHz	Units
Linear Gain	17.0	16.7	16.4	15.9	15.2	14.6	dB
Output Power	22.4	28.2	28.2	31.6	31.6	31.6	W
Power Gain	15.6	15.0	15.1	14.5	14.0	13.2	dB
Power Added Efficiency	30	37	37	39	38	37	%

Notes:
[1] Measured at -30 dBc, 1.6 MHz from carrier, in the CGHV96050F1-AMP (838176) under OQPSK modulation, 1.6 Msps, PN23, Alpha Filter = 0.2

Large Signal Models Available for ADS and MWO

RoHS compliant

Rev. 3, July 2024

Absolute Maximum Ratings (not simultaneous)

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}	57.6 / 86.4	W	(CW / Pulse)
Storage Temperature	T_{STG}	-65, +150	°C	
Operating Junction Temperature	T_J	225		
DC Drain Current	I_{DMAX}	5.6	A	
Maximum Forward Gate Current	I_{GMAX}	14.4	mA	25°C
Soldering Temperature[1]	T_S	245	°C	
Screw Torque	τ	40	in-oz	
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.4	°C/W	Pulse Width = 100µs, Duty Cycle = 10%, P_{DISS} = 86.4 W
Thermal Resistance, Junction to Case		2.12		CW, 85°C, P_{DISS} = 57.6 W
Case Operating Temperature[2]	T_C	-40, +150	°C	

Notes:
[1] Refer to the Application Note on soldering
[2] See also, Power Dissipation Derating Curve on page 10

Electrical Characteristics (Frequency = 7.9 - 8.4 GHz unless otherwise stated; 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	V_{DS} = 10 V, I_D = 14.4 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	—		—		V_{DS} = 40 V, I_D = 500 mA
Saturated Drain Current[2]	I_{DS}	11.5	13.0	—	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BR}	100	—	—	V	V_{GS} = -8 V, I_D = 14.4 mA
RF Characteristics[3]						
Small Signal Gain	S21	13.25	16	—	dB	V_{DD} = 40 V, I_{DQ} = 500 mA, P_{IN} = 20 dBm
Input Return Loss	S11	—	-4.9	-3.0		
Output Return Loss	S22	—	-10.7	-5.5		
Power Gain[3, 4] at 7.9 GHz	G_P	10.75	15.6	—		V_{DD} = 40 V, I_{DQ} = 500 mA, P_{OUT} = 44 dBm
Power Gain[3, 4] at 8.4 GHz			13.5	—		
Power Added Efficiency[3, 4] at 7.9 GHz	PAE	18	25	—	%	
Power Added Efficiency[3, 4] at 8.4 GHz			27	—		
OQPSK Linearity[3, 4] at 7.9 GHz	ACLR	—	—	-26	dBc	
OQPSK Linearity[3, 4] at 8.4 GHz		—	—			
Output Mismatch Stress	VSWR	—	—	5 : 1	Ψ	No damage at all phase angles, V_{DD} = 40 V, I_{DQ} = 500 mA

Notes:
[1] Measured on wafer prior to packaging
[2] Scaled from PCM data
[3] Measured at -30 dBc, 1.6 MHz from carrier, in the CGHV96050F1-AMP (838176) under OQPSK modulation, 1.6 Msps, PN23, Alpha Filter = 0.2
[4] Fixture loss de-embedded using the following offsets: At 7.9 GHz, input and output = 0.45 dB. At 8.4 GHz, input = 0.50 dB and output = 0.55 dB.

CGHV96050F1 Typical Performance

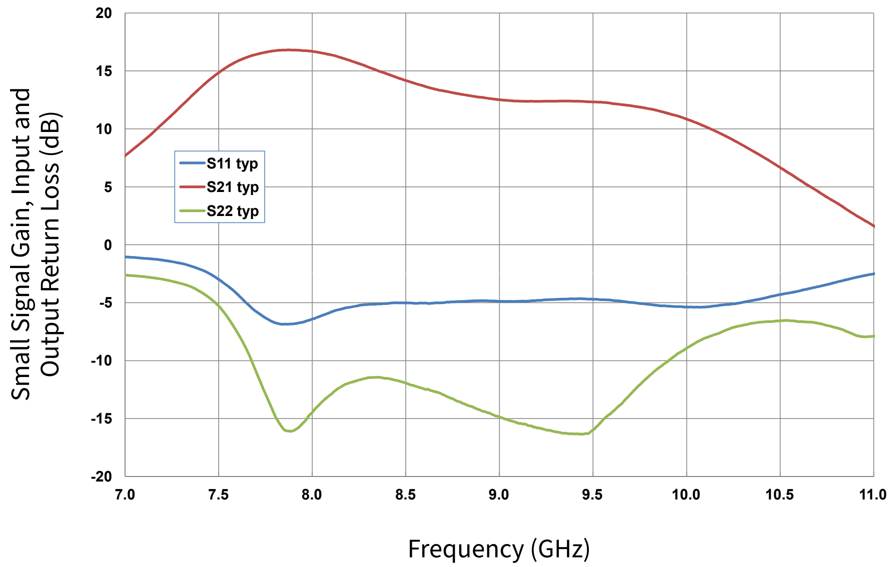


Figure 1. Small Signal Gain and Return Loss vs Frequency of CGHV96050F1 measured in CGHV96050F1-AMP
V_{DS} = 40 V, I_{DQ} 500 mA

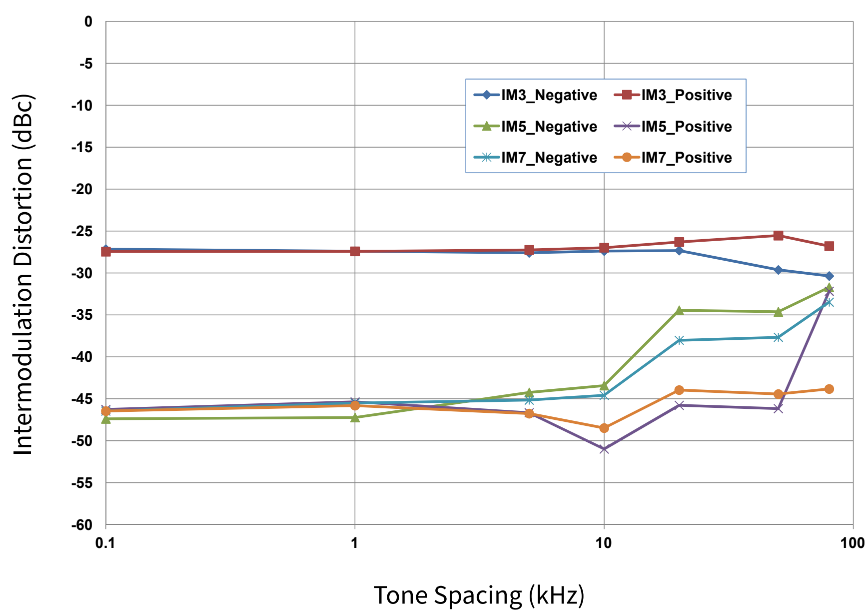


Figure 2. Intermodulation Distortion Performance vs Tone Spacing
V_{DD} = 40 V, ƒ = 8.2 GHz, Output Power = 44 dBm / 20 W

CGHV96050F1 Typical Performance

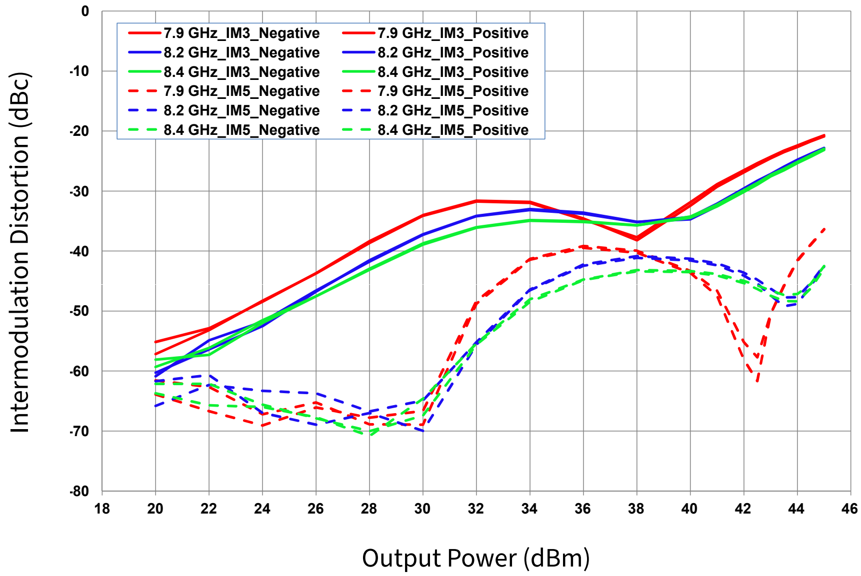


Figure 3. IM3 and IM5 vs Output Power at 7.9 GHz, 8.2 GHz, and 8.4 GHz
V_{DD} = 40 V, Tone Spacing = 100 kHz

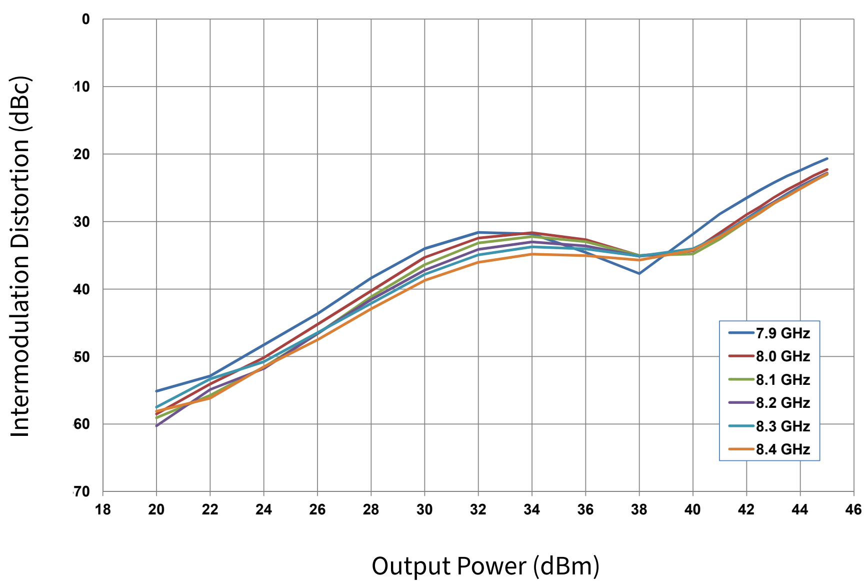


Figure 4. Two Tone IMS vs Output Power
V_{DD} = 40 V, Tone Spacing = 100 kHz

Rev. 3, July 2024

CGHV96050F1 Typical Performance

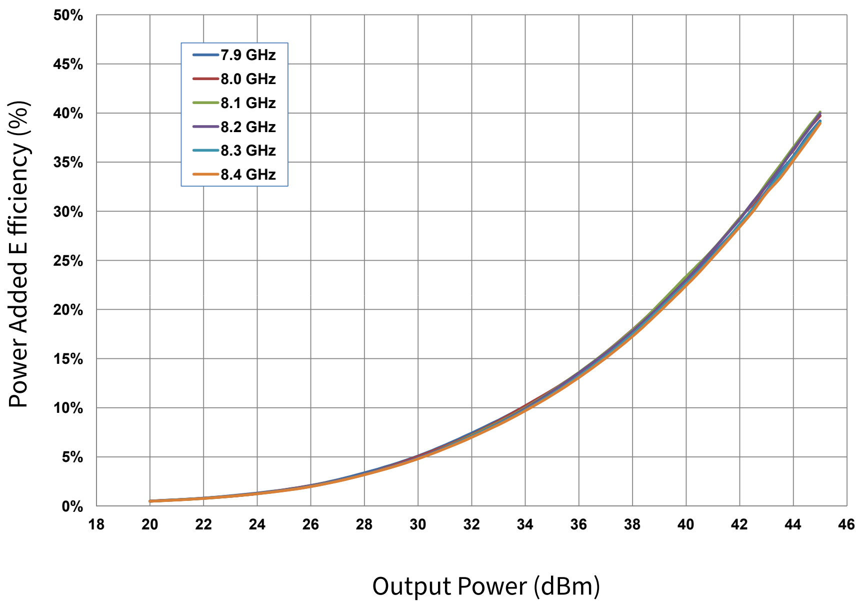


Figure 5. Two Tone Power Added Efficiency vs Output Power
V_{DD} = 40 V, Tone Spacing = 100 kHz

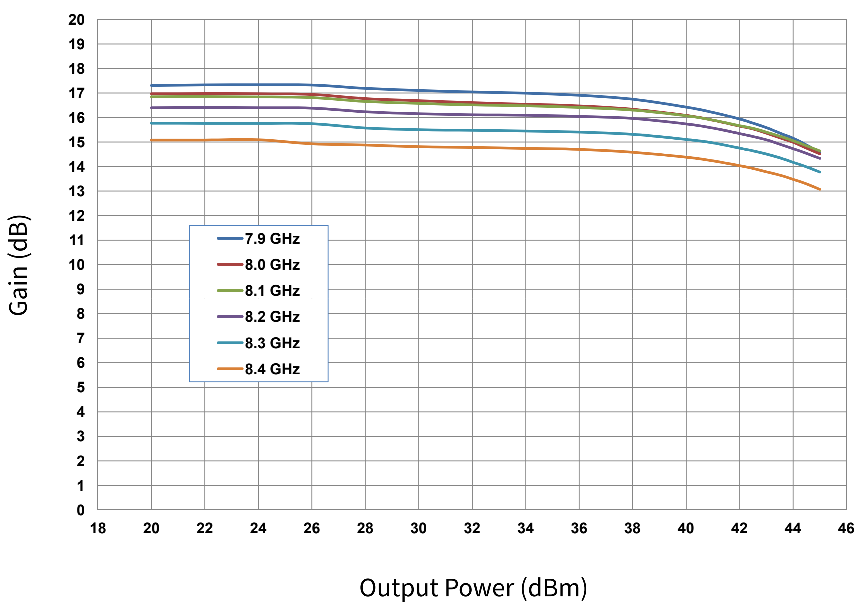


Figure 6. Two Tone Gain vs Output Power
V_{DD} = 40 V, Tone Spacing = 100 kHz

CGHV96050F1 Typical Performance

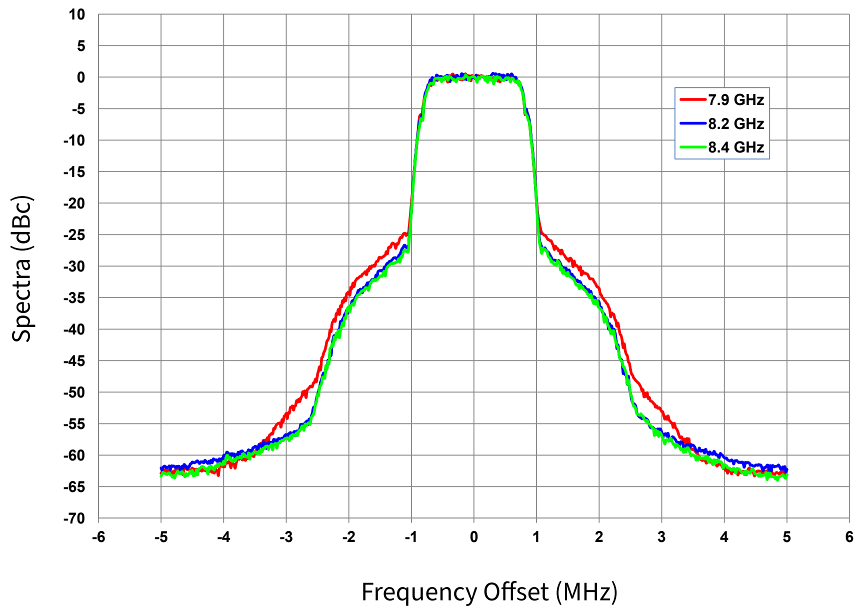


Figure 7. Spectral Mask under OQPSK Modulation, 1.6 Msps
V_{DD} = 40 V, Output Power = 44 dBm / 25 W

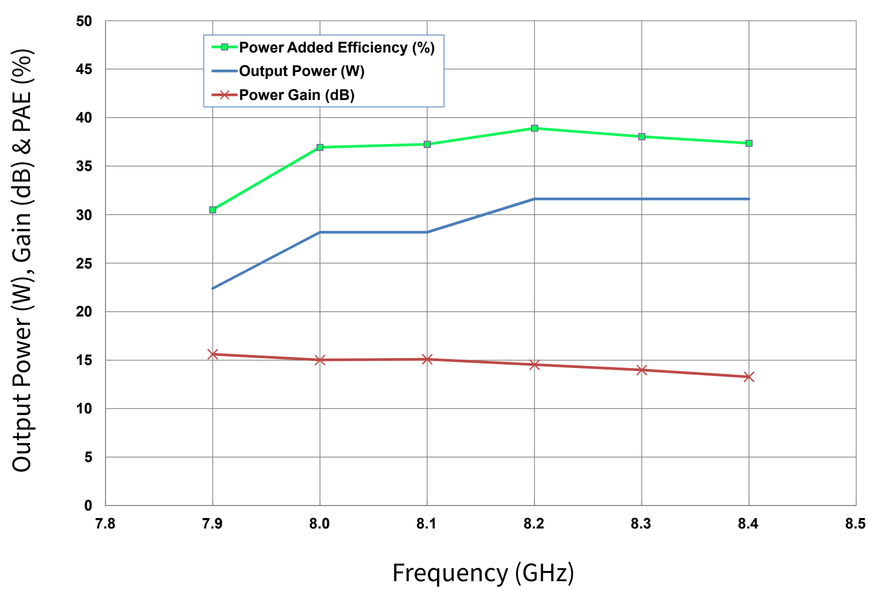


Figure 8. Linear Output Power, Gain and Power Added Efficiency vs Frequency
V_{DD} = 40 V, I_{DQ} = 500 mA, 1.6 Msps, OQPSK Modulation at -30 dBc

CGHV96050F1 Typical Performance

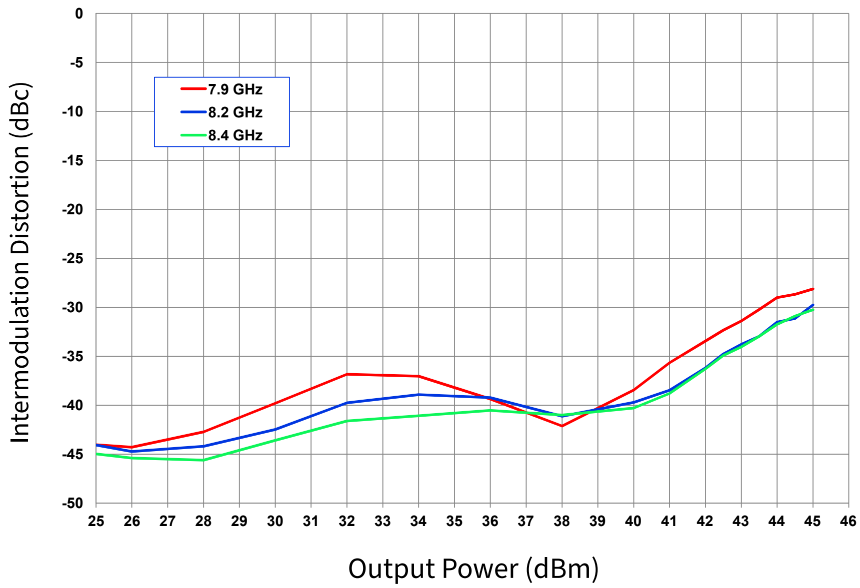


Figure 9. OQPSK Linearity vs Output Power
V_{DD} = 40 V, ƒ = 1.6 MHz

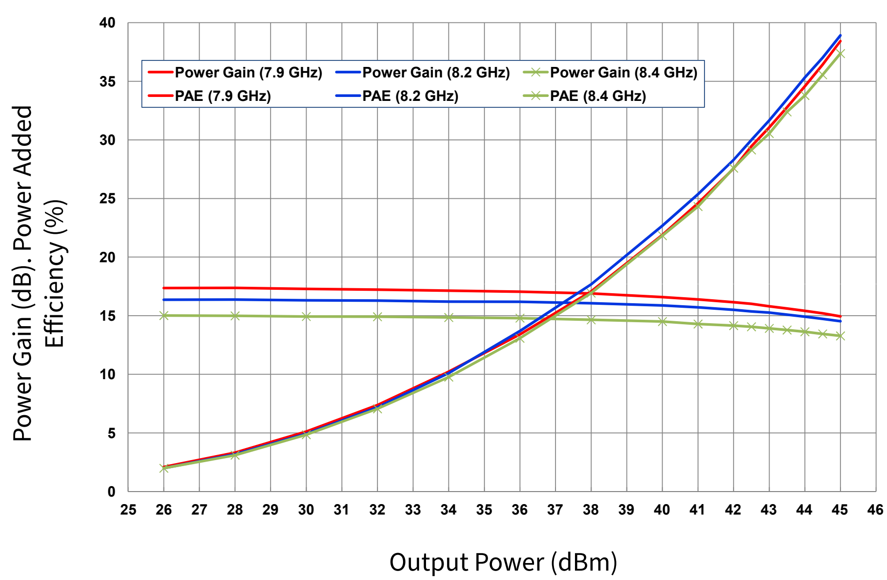


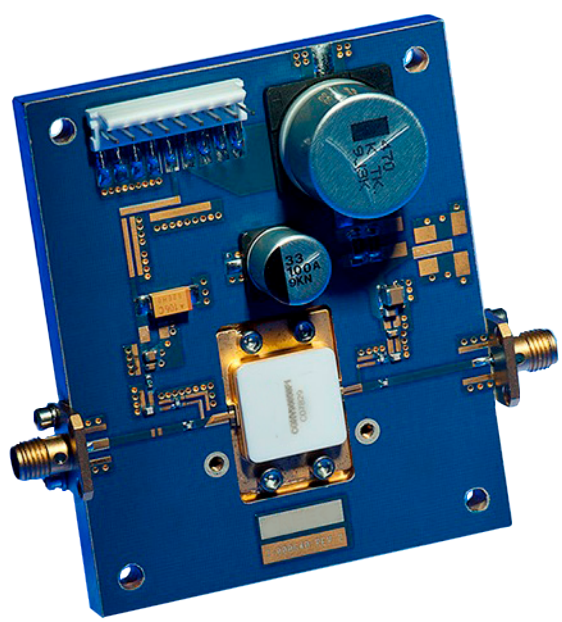
Figure 10. Power Gain and Power Added Efficiency vs Output Power
V_{DD} = 40 V, I_{DQ} = 500 mA, 1.6 Msps, OQPSK Modulation at -30 dBc

Rev. 3, July 2024

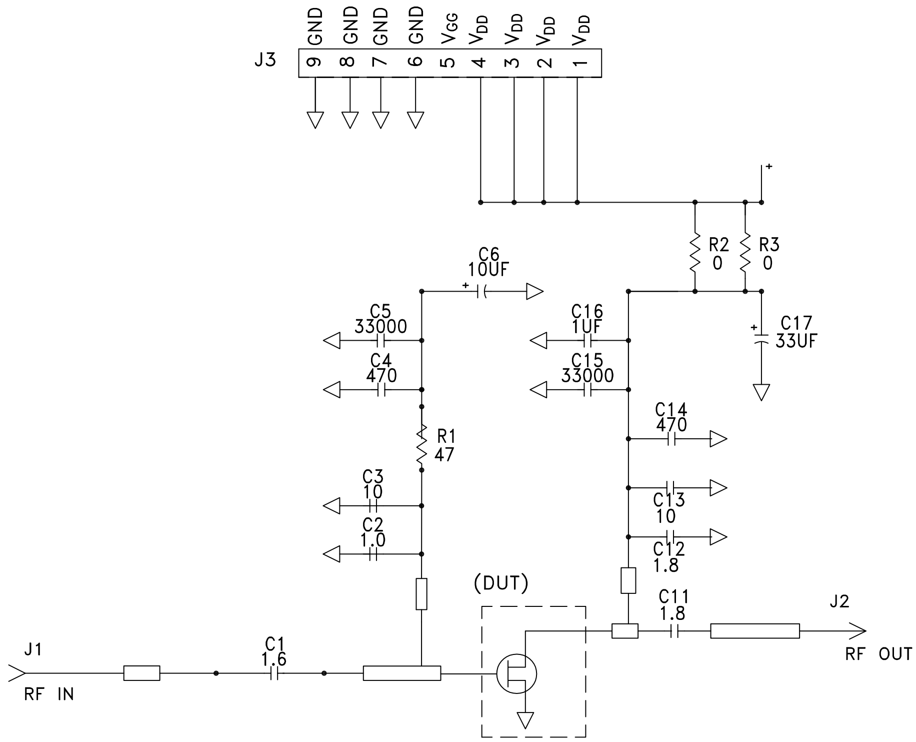
CGHV96050F1-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 47 OHM, +/-1%, 1/16 W, 0603, SMD	1
R2, R3	RES, 0 OHM +/-5%, 125 mW, 1206, SMD	2
C1	CAP, 1.6pF, +/- 0.1pF, 200V, 0402, ATC 600L	1
C2	CAP, 1.0pF, +/- 0.1pF, 200V, 0402, ATC 600L	1
C3, C13	CAP, 10pF +/-5%, 0603, ATC	2
C4, C14	CAP, 470pF +/-5%, 100 V, 0603	2
C5, C15	CAP, 33000pF, 0805, 100 V, X7R	2
C11, C12	CAP, 1.8pF, +/- 0.1 pF, 200V, 0402, ATC 600L	2
C16	CAP, 1µF +/-10%, 100 V, X7P, 1210	1
C17	CAP, 33µF +/-20%, G-CASE	1
C18	CAP, 470µF, +/-20%, ELECTROLYTIC	1
J1, J2	CONNECTOR, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20MIL	2
J3	CONNECTOR, HEADER, RT>PLZ .1CEN LK 9POS	1
-	PCB, TEST FIXTURE, TACONICS RF35P, 20 MIL THK, 440210 PKG	1
-	2-56 SOC HD SCREW 1/4 SS	4
-	#2 SPLIT LOCKWASHER SS	4
Q1	CGHV96050F1	1

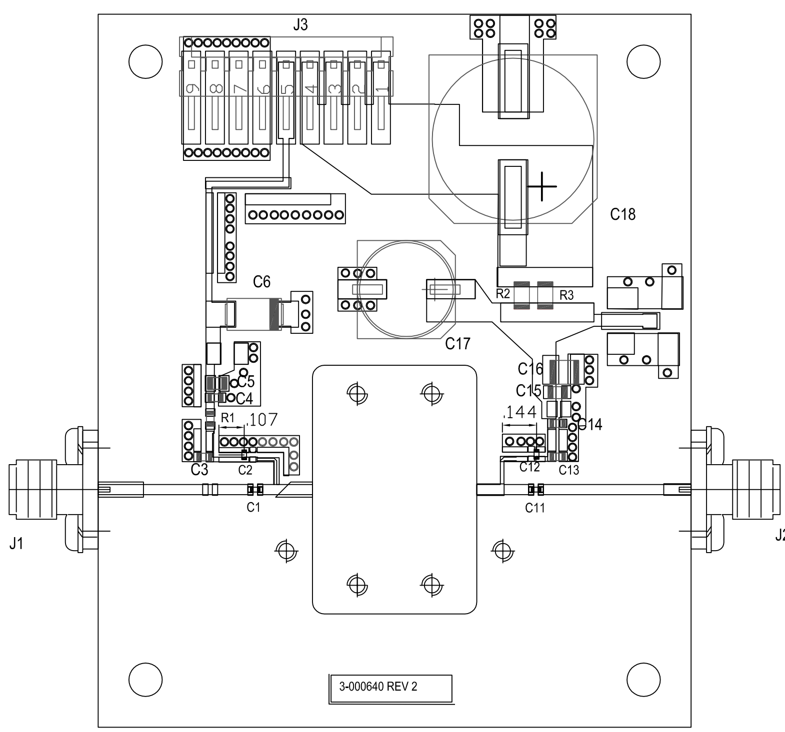
CGHV96050F1-AMP Demonstration Amplifier Circuit



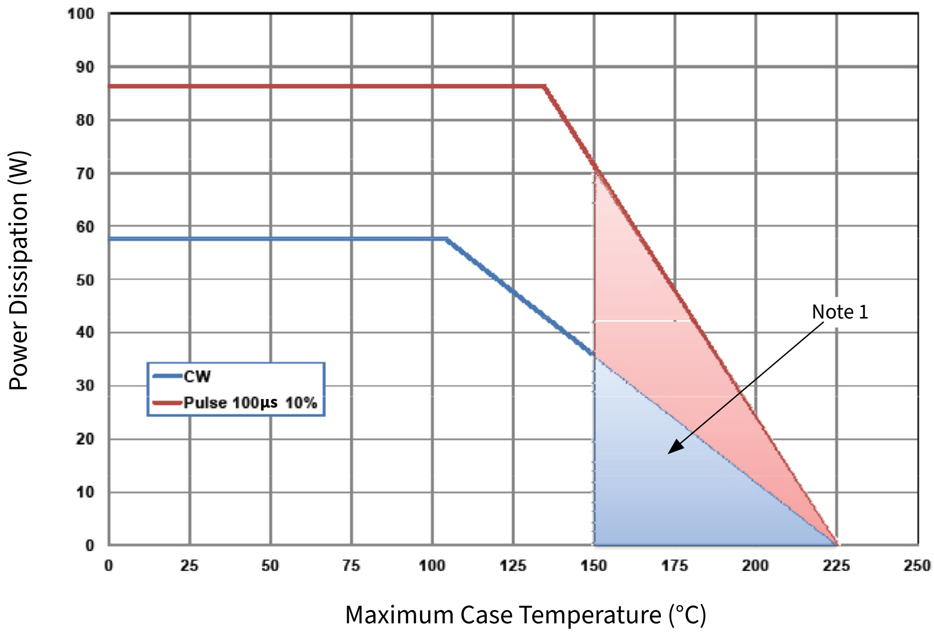
CGHV96050F1-AMP Demonstration Amplifier Circuit Schematic



CGHV96050F1-AMP Demonstration Amplifier Circuit Outline



CGHV96050F1 Power Dissipation De-rating Curve

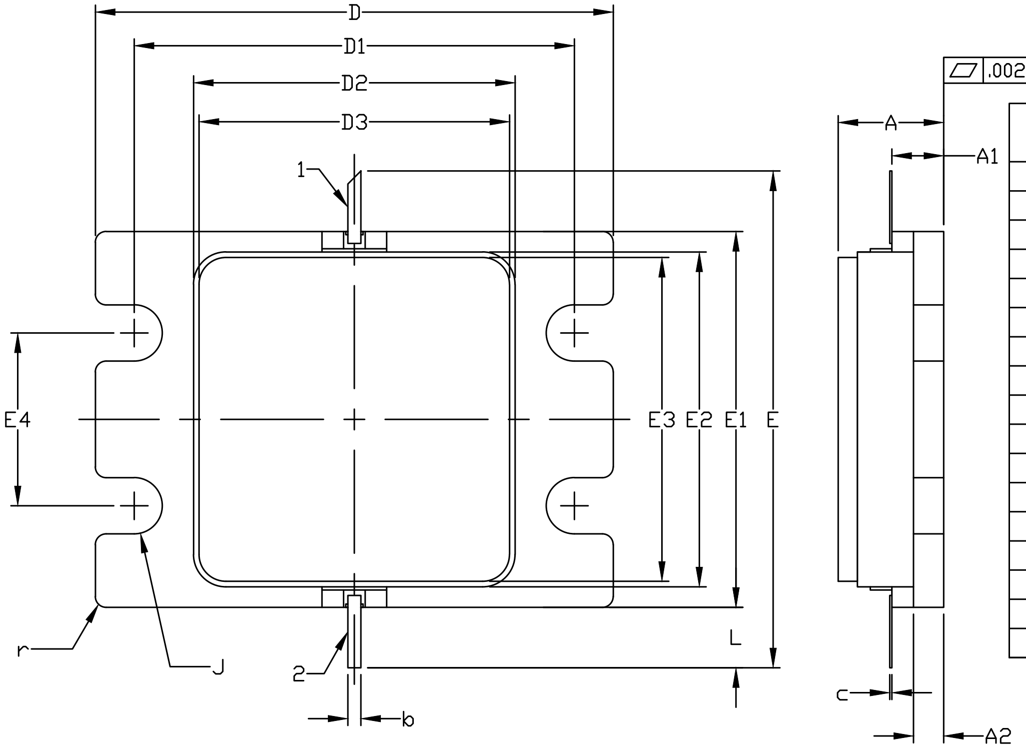


Notes:
[1] Area exceeds Maximum Case Temperature (See Page 2)

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

Product Dimensions CGHV96050F1 (Package Type — 440217)



DIM	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.185	0.201	4.70	5.11	
A1	0.088	0.100	2.24	2.54	2x
A2	0.049	0.061	1.24	1.55	
b	0.022	0.026	0.56	0.66	2x
c	0.003	0.006	0.08	0.15	
D	0.935	0.955	23.75	24.26	
D1	0.797	0.809	20.24	20.55	2x
D2	0.581	0.593	14.76	15.06	
D3	0.565	0.571	14.35	14.50	
E	0.906		23.01		REF
E1	0.679	0.691	17.25	17.55	
E2	0.604	0.616	15.34	15.65	
E3	0.588	0.594	14.93	15.09	
E4	0.309	0.321	7.85	8.15	2x
J	ø0.097	ø0.107	ø2.46	ø2.72	4x
L	0.090	0.130	2.29	3.30	2x
r	0.02 TYP		0.51 TYP		12x

Part Number System

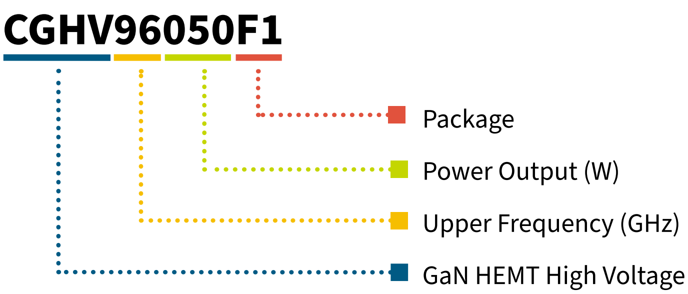


Table 1.

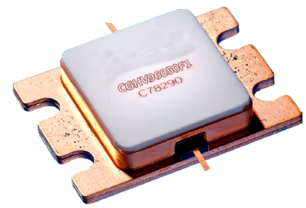
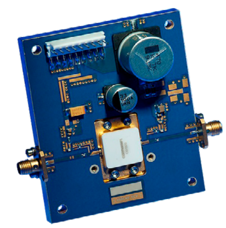
Parameter	Value	Units
Upper Frequency[1]	9.6	GHz
Power Output	50	W
Package	Flange	—

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
CGHV96050F1	GaN HEMT	Each	
CGHV96050F1-AMP	Test board with GaN HEMT installed	Each	

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