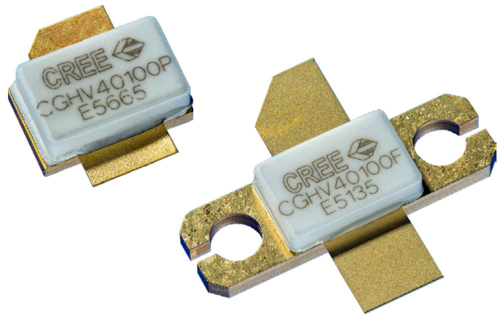
CGHV40100

100 W, DC - 3.0 GHz, 50 V, GaN HEMT



Package Types: 440193 & 440206
PN: CGHV40100F & CGHV40100P

Description

Cree's CGHV40100 is an unmatched, gallium nitride (GaN) high electron mobility transistor (HEMT). The CGHV40100, operating from a 50 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 CGHV40100 ideal for linear and compressed amplifier circuits. The transistor is available in a 2-lead flange and pill package.

Typical Performance Over 500 MHz - 2.5 GHz (T_C = 25˚C), 50 V

Parameter	500 MHz	1.0 GHz	1.5 GHz	2.0 GHz	2.5 GHz	Units
Small Signal Gain	17.6	16.9	17.7	17.5	14.8	dB
Saturated Output Power	147	100	141	116	112	W
Drain Efficiency @ P_{SAT}	68	56	58	54	54	%
Input Return Loss	6	5.1	10.5	5.5	8.8	dB

Notes: Measured CW in the CGHV40100F-AMP application circuit.

Features

- Up to 3 GHz Operation
- 100 W Typical Output Power
- 17.5 dB Small Signal Gain at 2.0 GHz
- Application Circuit for 0.5 - 2.5 GHz
- 55% Efficiency at P_{SAT}
- 50 V Operation

Large Signal Models Available for ADS and MWO

RoHS COMPLIANT

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

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DSS}	150	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}	20.8	mA	25˚C
Maximum Drain Current[1]	I_{DMAX}	8.7	A	25˚C
Soldering Temperature[2]	T_S	245	˚C	
Screw Torque	τ	40	in-oz	
Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	1.62	˚C/W	85˚C
Thermal Resistance, Junction to Case[4]	$R_{\theta JC}$	1.72	˚C/W	85˚C
Case Operating Temperature[5]	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 CGHV40100P at P_{DISS} = 83 W
[4] Measured for the CGHV40100F at P_{DISS} = 83 W
[5] See also, Power Derating Curve on Page 5

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 = 20.8 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	V_{DC}	V_{DS} = 50 V, I_D = 0.6 A
Saturated Drain Current[2]	I_{DS}	13.5	19.3	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BR}	100	–	–	V_{DC}	V_{GS} = -8 V, I_D = 20.8 mA
RF Characteristics[3] (T_C = 25˚C, F_0 = 2.0 GHz unless otherwise noted)						
Small Signal Gain	G_{SS}	16	17.5	–	dB	V_{DD} = 50 V, I_{DQ} = 0.6 A
Power Gain	G_P	–	11.0	–	dB	V_{DD} = 50 V, I_{DQ} = 0.6 A, P_{OUT} = P_{SAT}
Output Power at Saturation[4]	P_{SAT}	100	116	–	W	V_{DD} = 50 V, I_{DQ} = 0.6 A
Drain Efficiency	η	47	54	–	%	V_{DD} = 50 V, I_{DQ} = 0.6 A, P_{OUT} = P_{SAT}
Output Mismatch Stress	VSWR	–	–	10 : 1	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 0.6 A, P_{OUT} = 100 W CW
Dynamic Characteristics[5]						
Input Capacitance	C_{GS}	–	29.3	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	7.3	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	0.61	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz

Notes:
[1] Measured on wafer prior to packaging
[2] Scaled from PCM data
[3] Measured in CGHV40100-AMP
[4] P_{SAT} is defined as I_G = 0.208 mA
[5] Includes package

CGHV40100 Typical Performance

Figure 1. Small Signal Gain and Return Losses versus Frequency measured in application circuit CGHV40100-AMP
V_{DD} = 50 V, I_{DQ} = 600 mA, Tcase = 25°C

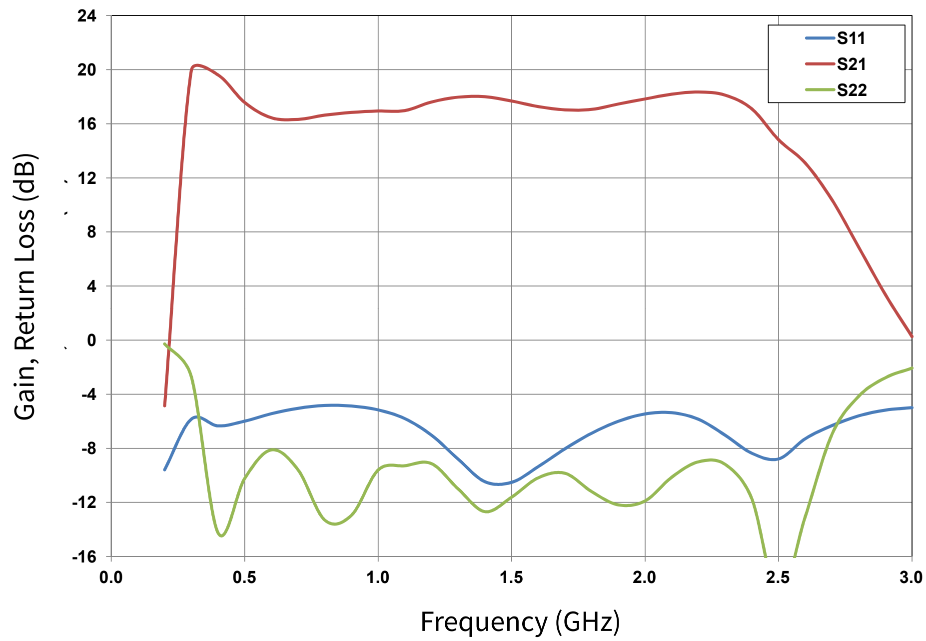
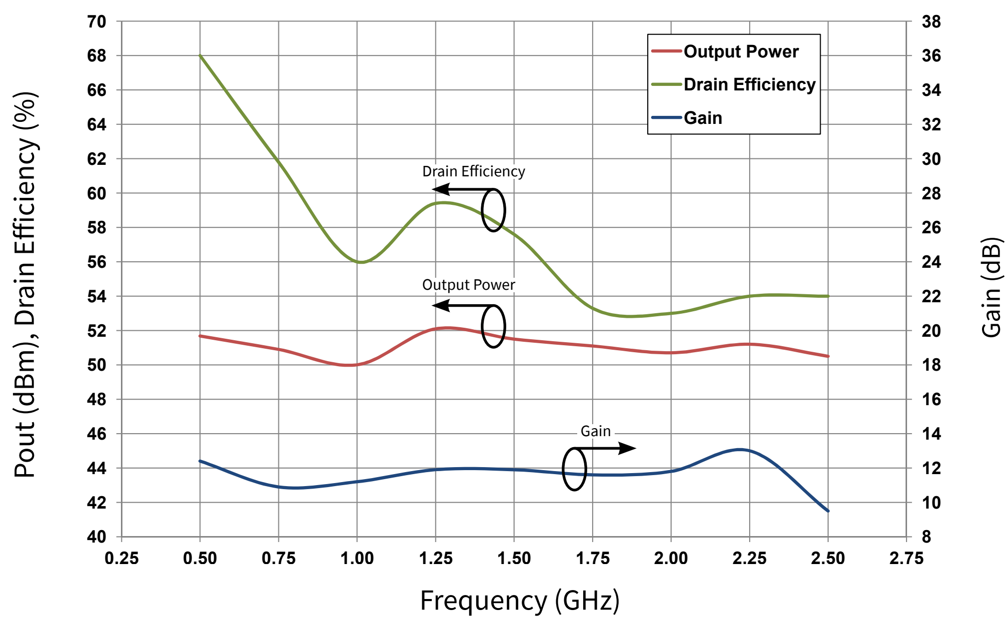


Figure 2.Output Power and Drain Efficiency vs Frequency
V_{DD} = 50 V, I_{DQ} = 600 mA



CGHV40100 Typical Performance

Figure 3. Third Order Intermodulation Distortion vs Average Output Power measured in Broadband Amplifier Circuit CGHV40100-AMP Spacing = 1 MHz, V_{DD} = 50 V, I_{DQ} = 600 mA, Tcase = 25°C

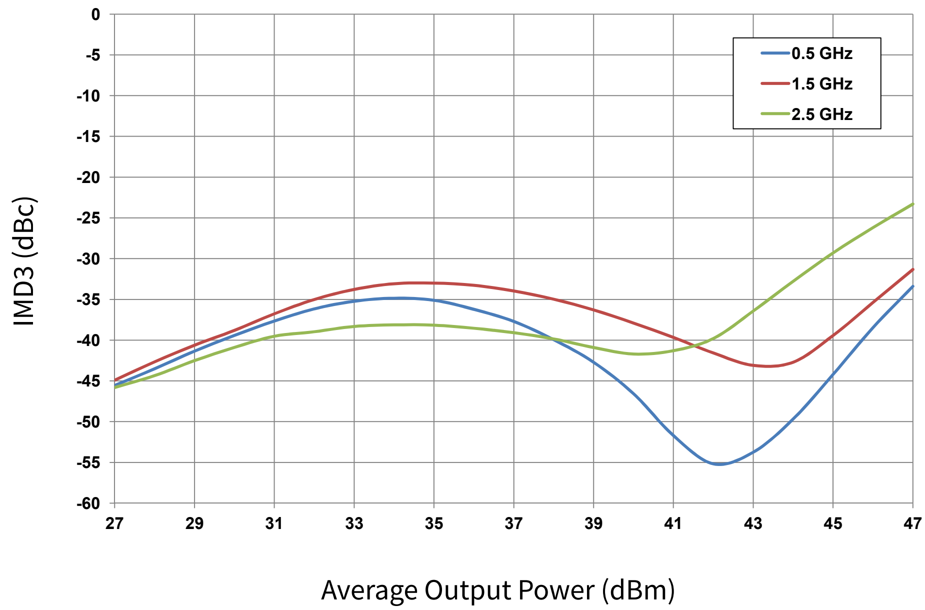
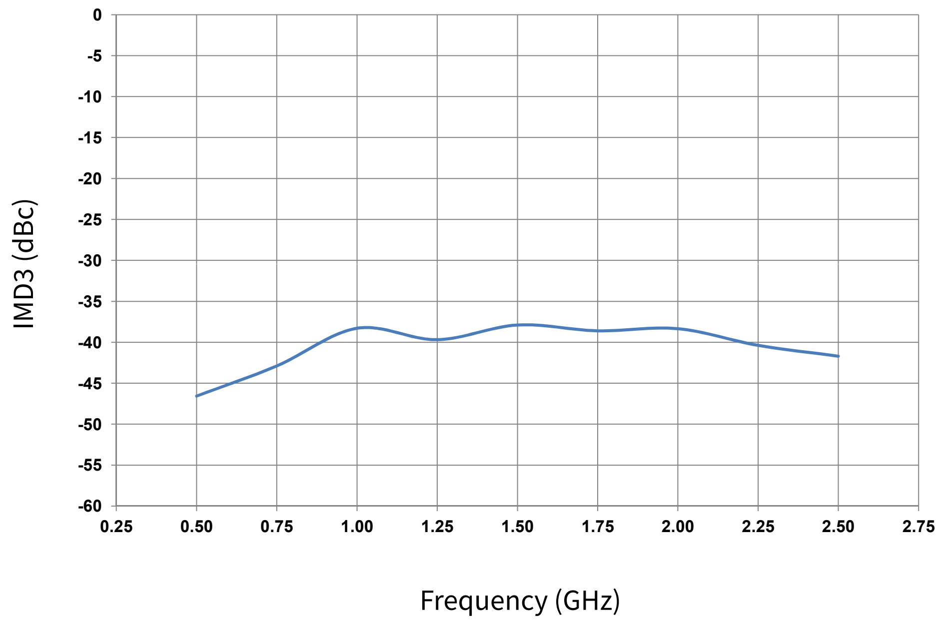
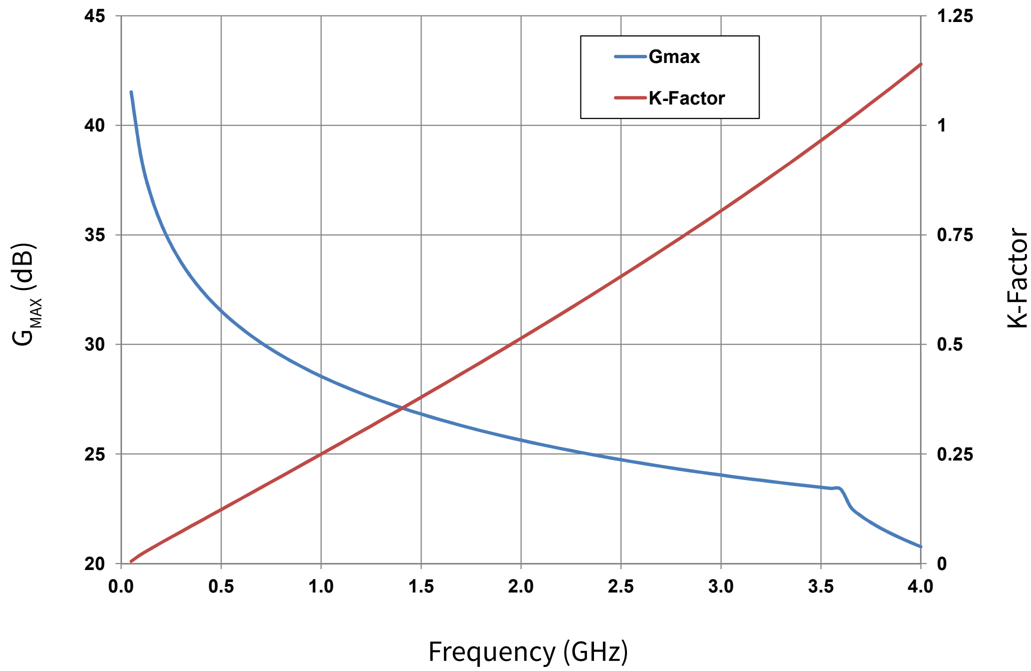


Figure 4. Third Order Intermodulation Distortion vs Frequency measured in Broadband Amplifier Circuit CGHV40100-AMP Spacing = 1 MHz, V_{DD} = 50 V, I_{DQ} = 600 mA, Tcase = 25°C

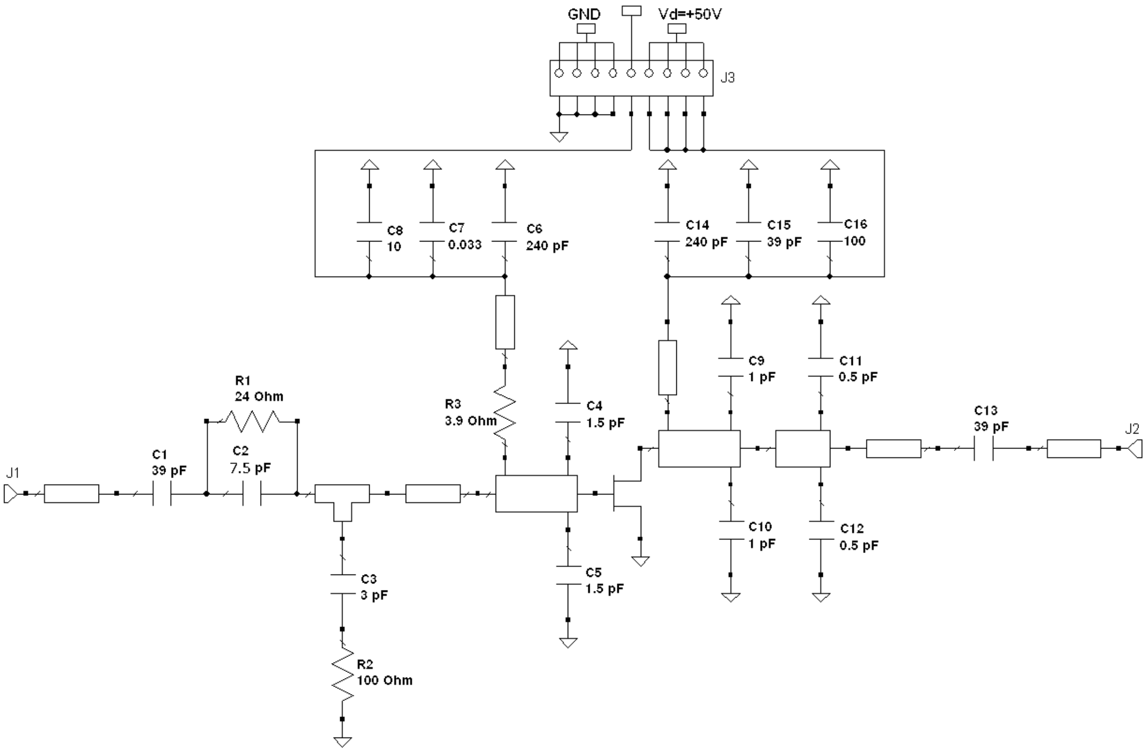


CGHV40100 Typical Performance

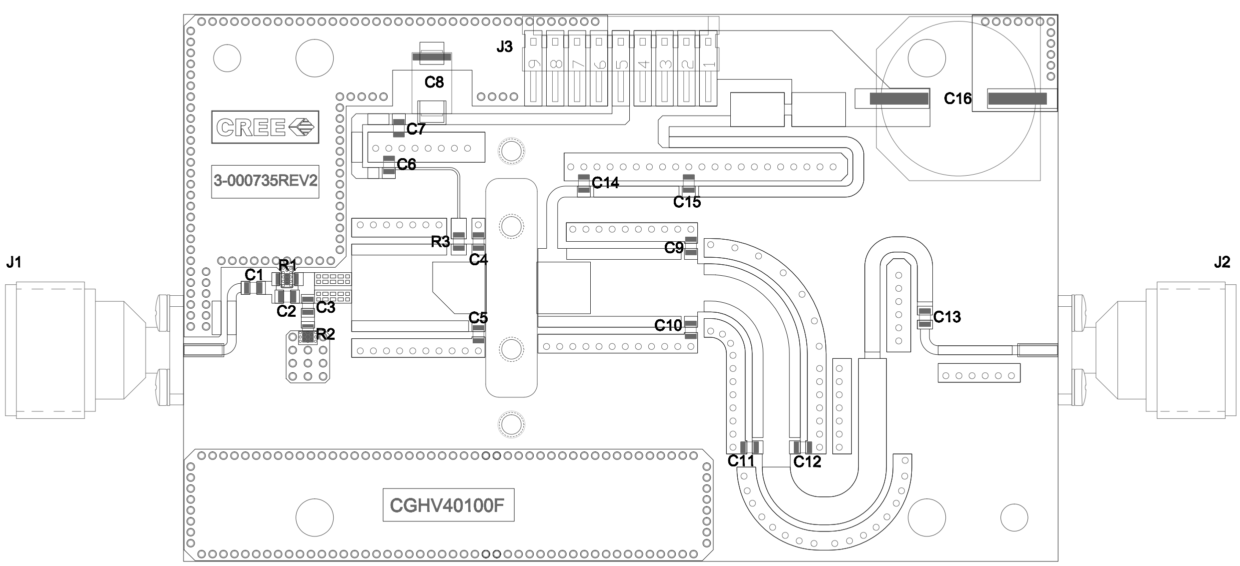
Figure 5. G_{MAX} and K-Factor vs Frequency
V_{DD} = 50 V, I_{DQ} = 600 mA, Tcase = 25°C



CGHV40100-AMP Application Circuit Schematic



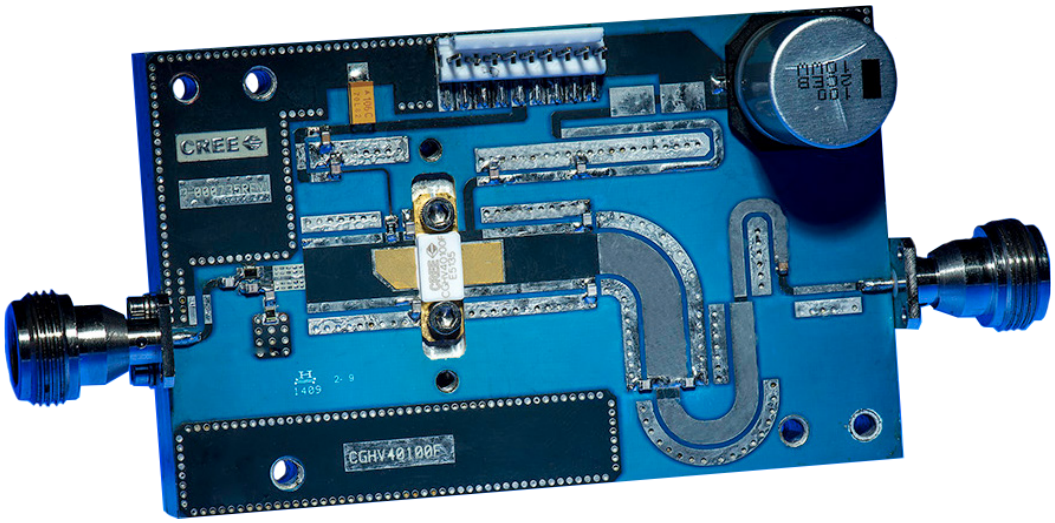
CGHV40100-AMP Application Circuit



CGHV40100-AMP Application Circuit Bill of Materials

Designator	Description	Qty
C1, C13, C15	CAP, 39 pF, ± 0.1 pF, 250V, 0805, ATC600F	3
C2	CAP, 7.5 pF, ± 0.1 pF, 250 V, 0806, ATC600F	1
C3	CAP, 3 pF ± 0.1 pF, 250 V, 0805, ATC600F	1
C4, C5	CAP, 1.5 pF, ± 0.1 pF, 250 V, 0805, ATC600F	2
C7	CAP, 33000 pF, 0805 100V, X7R	1
C6, C14	CAP, 240 pF, ± 0.5 pF, 250 V, 0805, ATC600F	2
C8	CAP, 10 UF, 16V TANTALUM, 2312	1
C9, C10	CAP, 1 pF, ± 0.1 pF, 250 V, 0805, ATC600F	2
C11, C12	CAP, 0.5 pF, ± 0.1 pF, 250 V, 0805, ATC600F	2
C16	CAP, 100 UF, 20%, 160 V, ELEC	1
R1	RES, 24 OHMS, IMS ND3-1005CS24R0G	1
R2	RED, 100 OHMS, IMS ND3-0805EW1000G	1
R3	RES, 3.9 OHMS, 0805	1
J1, J2	CONN, SMA, PANEL MOUNT JACK	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
–	BASEPLATE, CGH35120	1
–	PCB, RO4350B, 2.5” X 4” X 0.020”, CGHV40100F	1

CGHV40100-AMP Demonstration Amplifier Circuit



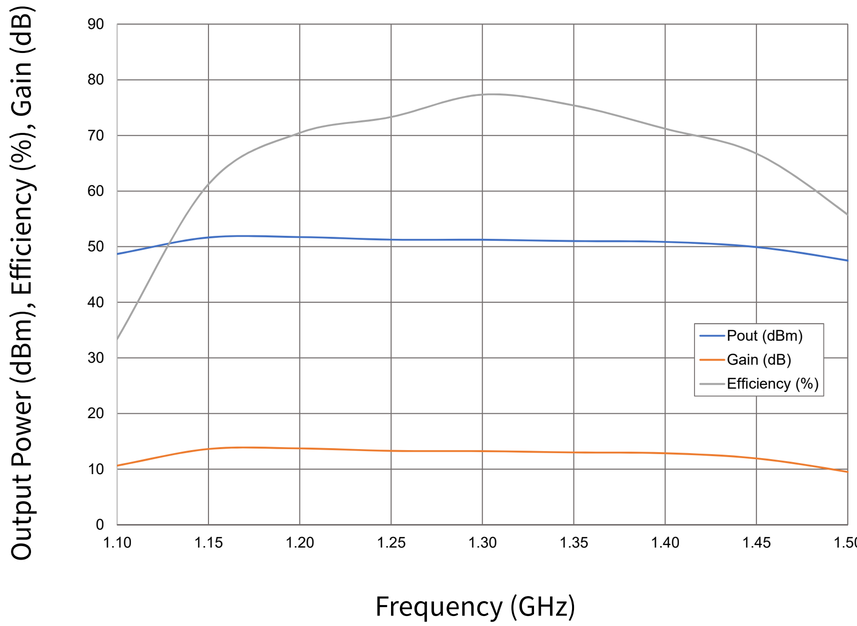
Electrical Characteristics When Tested in CGHV40100F-AMP2

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
RF Characteristics[1] (T_C = 25 ˚C, F_0 = 1.2 - 1.4 GHz unless otherwise noted)						
Output Power	P_{OUT}	–	51	–	dBm	V_{DD} = 50 V, I_{DQ} = 10 mA, P_{IN} = 38 dBm
Drain Efficiency	η	–	72	–	%	V_{DD} = 50 V, I_{DQ} = 10 mA, P_{IN} = 38 dBm
Output Mismatch Stress	VSWR	–	10 : 1	–	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 10 mA, P_{IN} = 38 dBm

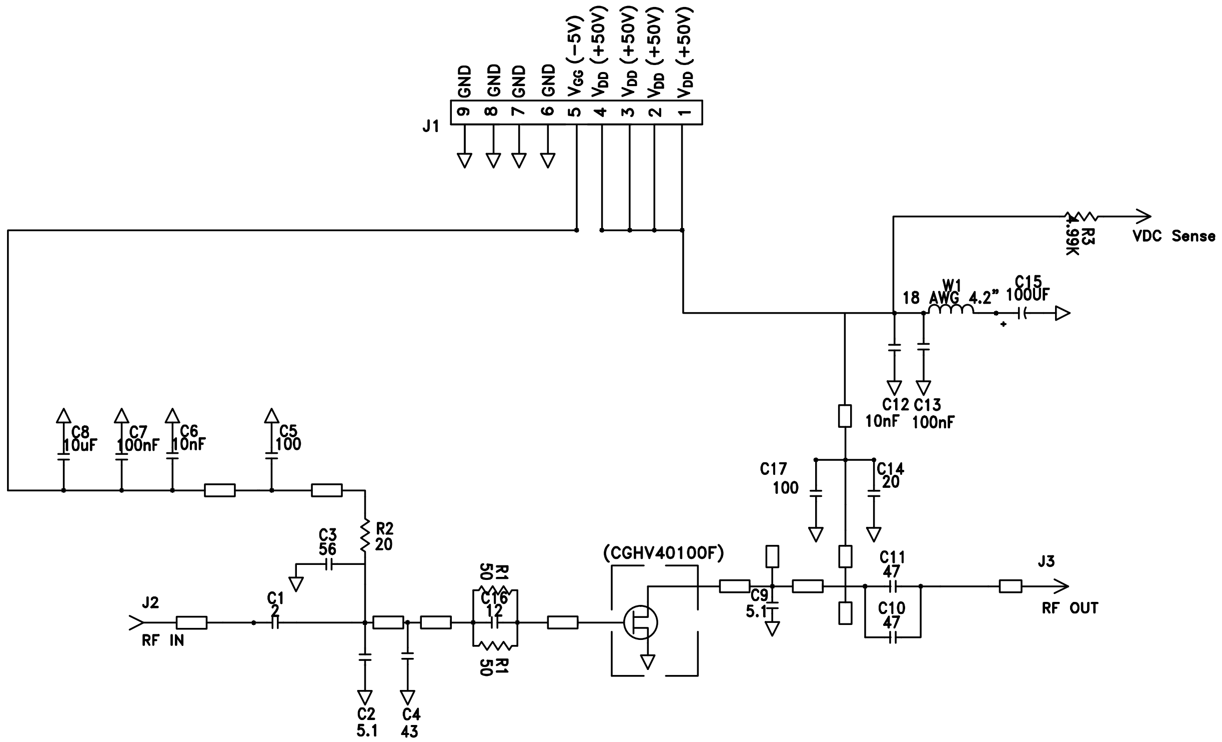
Note[1]: Measured in CGHV40100F-AMP2 Application Circuit

Typical Performance in Application Circuit CGHV40100F-AMP2

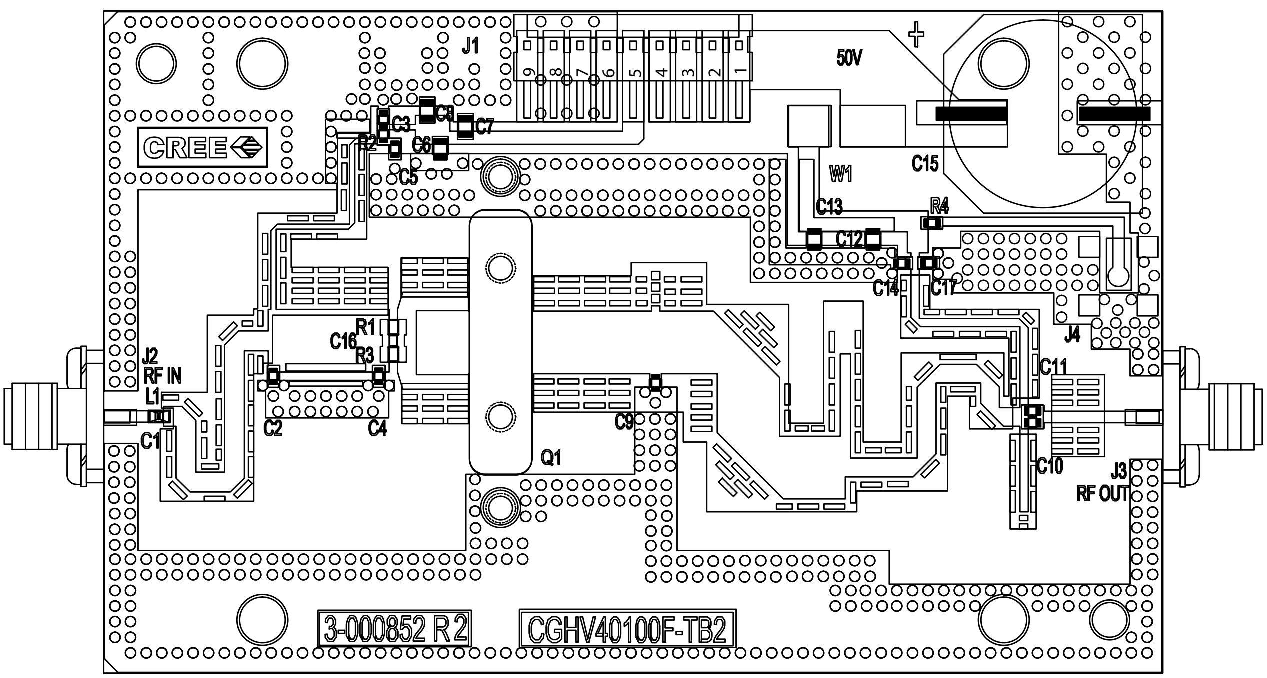
Figure 6. Output Power, Efficiency, and Gain vs. Frequency of the CGHV40100F Measured in Demonstration Amplifier Circuit CGHV40100F-AMP2 V_{DD} = 50 V, I_{DQ} = 10 mA, Pulse Width = 100 µS, Duty Cycle = 10%



CGHV40100F-AMP2 Demonstration Amplifier Circuit Schematic



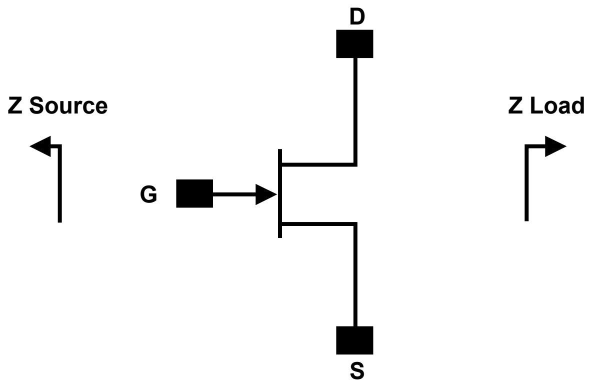
CGHV40100F-AMP2 Demonstration Amplifier Circuit Outline



CGHV40100F-AMP2 Bill of Materials

Designator	Description	Qty
C1	CAP, 2.0pF, +/-0.1pF, 0603, ATC	1
R2	RES, 1/16W, 0603, 1%, 20 Ohms	1
R4	RES,1/16W,0603,1%,4.99K OHMS	1
R1, R3	RES, AlN, 50.0 OHM, +/- 5%, 0505, PtAg TERMINATION	1
C8	CAP, 10UF, 10%, 1206, 16V	1
C1, C5, C17	CAP, 100.0pF, +/-5%, 0603, ATC	3
C16	CAP, 12.0pF, +/-5%, 0603, ATC600	1
C14	CAP, 20.0pF, +/-5%, 0603, ATC600S	1
C4	CAP, 43pF,+/-5%pF, 0603, ATC	1
C10, C11	CAP, 47pF,+/-5%pF, 0603, ATC	2
C3	CAP, 56PF +/- 5%, 0603 , ATC600S	1
C2, C9	CAP, 5.1PF, +/-0.05 PF, 0603, 600S	2
C6, C12	CAP,0805,100V,TEMP STBL,1000PF	2
C7, C13	CAP, 10000PF, +/-10%, 0805, X7R, 100V, TEMP STBL	2
–	PCB, RO4350, 0.020 THK, CGHV40100F-TB2 1.2-1.4GHz RADAR	1
–	BASEPLATE, AL, 4.00 X 2.50 X 0.49 FOR THRU HOLE CAPACITORS	1
–	2-56 SOC HD SCREW 1/4 SS	4
–	#2 SPLIT LOCKWASHER SS	4
J2, J3	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST	2
J4	CONN, SMB, STRAIGHT JACK RECEPTACLE, SMT, 50 OHM, Au PLATED	1
J1	HEADER RT>PLZ .1CEN LK 9POS	1
W1	WIRE, BLACK, 18 AWG, EXTRUDED TFE TEFLON	1
L1	INDUCTOR,CHIP,2.2nH,0603 SMT	1
C2	CAP, 6.8pF, +/- 0.25 pF, 0603, ATC	1
C15	CAP, 100uF, +/-20%, 100V, ALUM ELEC	1
Q1	Transistor CGHV40100F	1

Source and Load Impedances



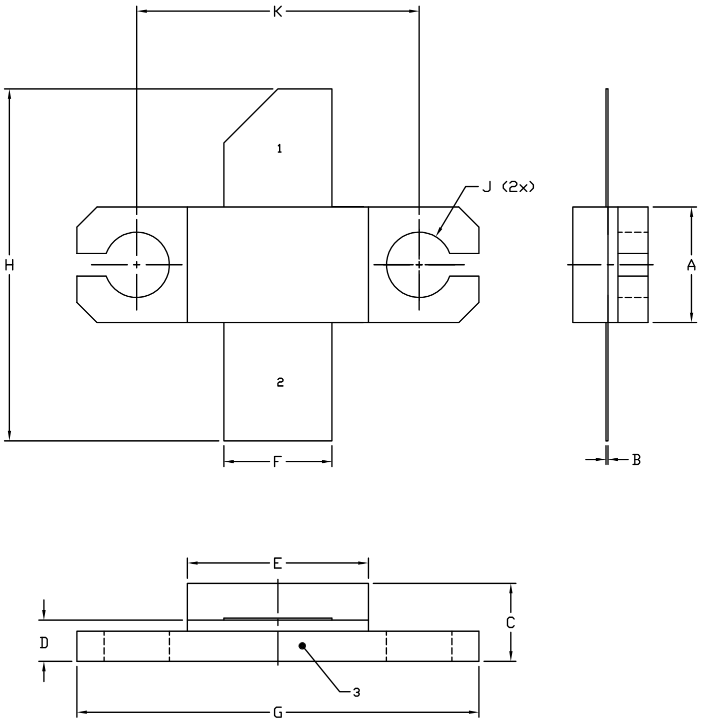
Frequency (MHz)	Z Source	Z Load
500	0.43 + j5.25	8.83 + j0.85
750	0.40 + j2.62	10.78 + j2.50
1000	0.30 + j1.31	9.06 + 4.23
1250	0.30 + j0.44	7.40 + j3.85
1500	0.30 - j0.44	6.39 + j3.44
1750	0.25 - j0.87	4.41 + j3.03
2000	0.25 - j1.31	3.68 + j2.17
2250	0.25 - j2.18	3.42 + j2.17
2500	0.26 - j2.62	2.65 + j1.74

Note 1. V_{DD} = 50 V, I_{DQ} = 600 mA in the 440193 package
Note 2. Optimized for power gain, P_{SAT} and PAE

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	2 (125 V to 250 V)	JEDEC JESD22 C101-C

Product Dimensions CGHV40100F (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.

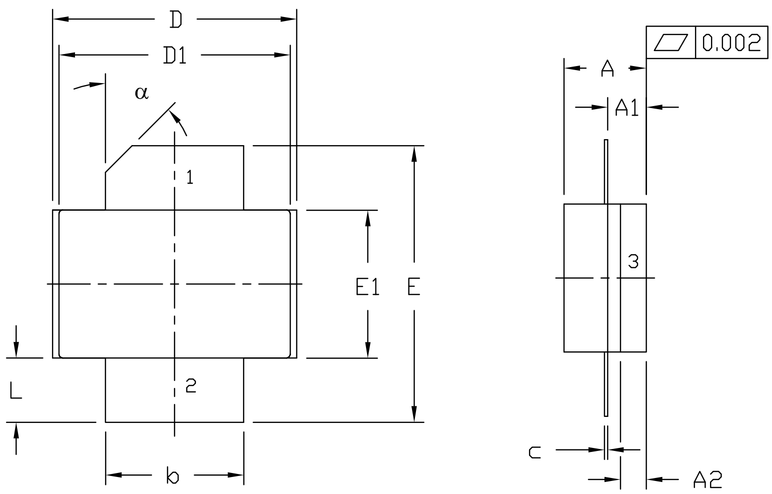
4. LID MAY BE MISALIGNED TO THE BODY OF THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

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

Product Dimensions CGHV40100P (Package Type — 440206)



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.

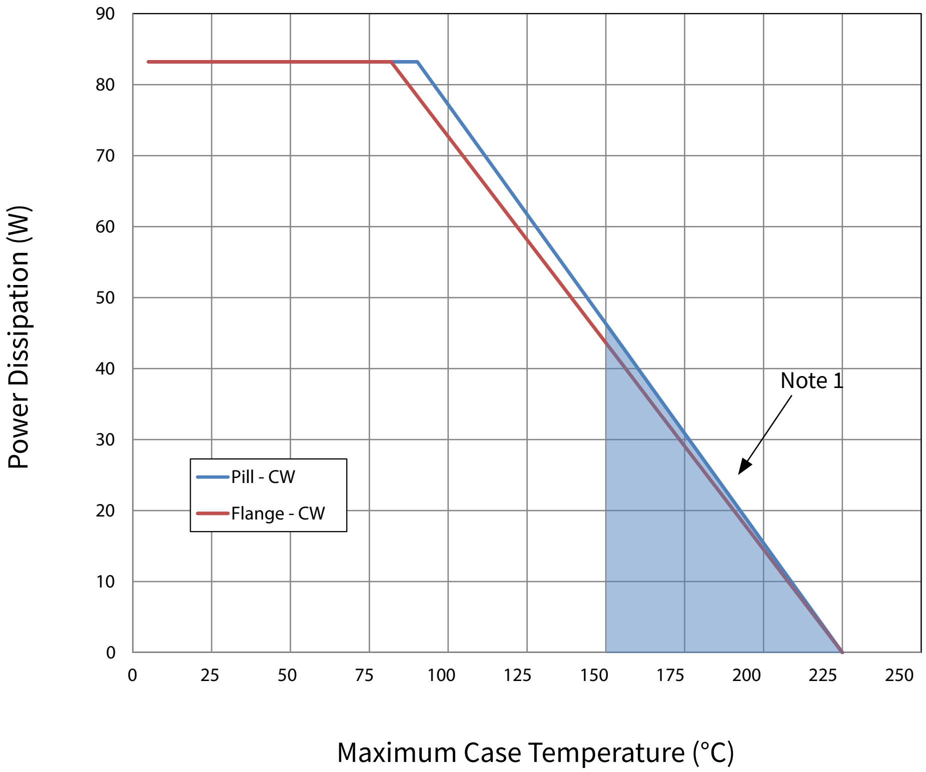
4. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

DIM	INCHES		MILLIMETERS		NOTES
	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

CGHV40100 Power Dissipation De-rating Curve

Figure 7. Transient Power Dissipation De-Rating Curve



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

Part Number System

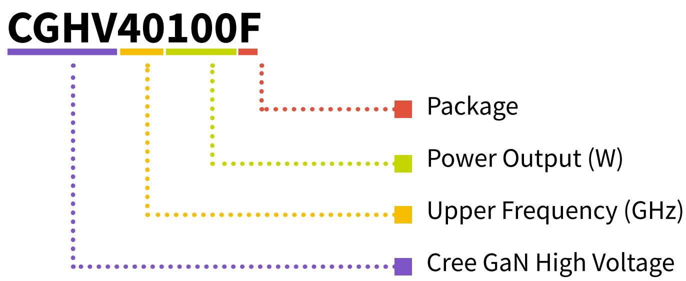


Table 1.

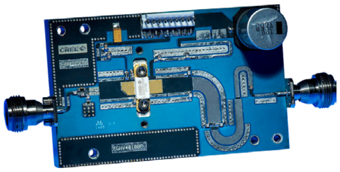
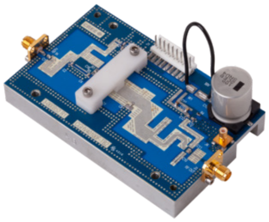
Parameter	Value	Units
Upper Frequency[1]	4.0	GHz
Power Output	100	W
Package	Flange	-

Note1: 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
CGHV40100F	GaN HEMT	Each	
CGHV40100P	GaN HEMT	Each	
CGHV40100F-AMP	Test board with GaN HEMT (CGHV40100F) installed, operating from 0.5 - 2.5 GHz for communications or ISM applications.	Each	
CGHV40100F-AMP2	Test board with GaN HEMT (CGHV40100F) installed, operating from 1.2 - 1.4 GHz for L-Band Radar.		

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www.wolfspeed.com/RF

Sales Contact
RFSales@cree.com

Notes

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