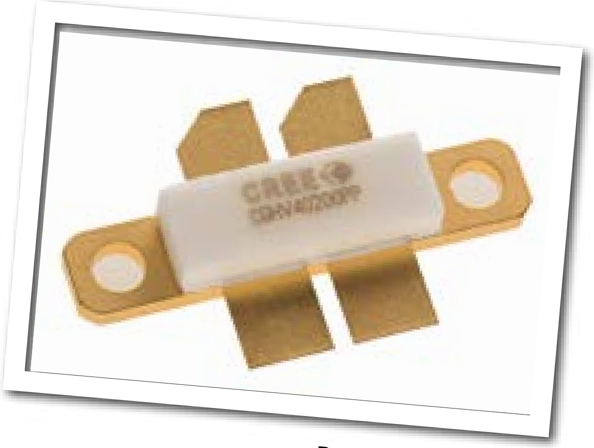
CGHV40200PP

200 W, 50 V, GaN HEMT

Cree's CGHV40200PP is an unmatched, gallium nitride (GaN) high electron mobility transistor (HEMT). The CGHV40200PP, 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 CGHV40200PP ideal for linear and compressed amplifier circuits. The transistor is available in a 4-lead flange package.



Package Type: 440199
PN: CGHV40200PP

Typical Performance Over 1.7-1.9 GHz (T_c = 25˚C), CW

Parameter	1.7 GHz	1.8 GHz	1.9 GHz	Units
Small Signal Gain	21.7	21.0	20.1	dB
Gain @ P_{in} = 38 dBm	16.5	16.1	15.4	dB
P_{OUT} @ P_{IN} = 38 dBm	270	250	218	W
Drain Efficiency @ P_{IN} = 38 dBm	64	67	65	%

FEATURES

- Up to 3.0 GHz Operation
- 21 dB Small Signal Gain at 1.8 GHz
- 250 W typical P_{SAT}
- 67 % Efficiency at P_{SAT}
- 50 V Operation

APPLICATIONS

- 2-Way Private Radio
- Broadband Amplifiers
- Cellular Infrastructure
- Test Instrumentation
- Class A, AB, Linear amplifiers suitable for OFDM, W-CDMA, EDGE, CDMA waveforms

Large Signal Models Available for ADS and MWO

Rev 1.1 – December 2017

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

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DSS}	125	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[1]	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	80	in-oz	
Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	0.94	˚C/W	85˚C
Case Operating Temperature[3,4]	T_C	-40, +150	˚C	

Note:
[1] Current limit for long term, reliable operation per side of the device
[2] Refer to the Application Note on soldering at www.cree.com/RF/Document-Library
[3] CGHV40200PP at P_{DISS} = 166 W.
[4] See also, the Power Dissipation De-rating Curve on Page .

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 = 2.0 A
Saturated Drain Current[2]	I_{DS}	15.6	18.7	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BR}	150	–	–	V_{DC}	V_{GS} = -8 V, I_D = 20.8 mA
RF Characteristics[3,4] (T_C = 25˚C, F_0 = 1.8 GHz unless otherwise noted)						
Small Signal Gain	G_{SS}	17.75	20.0	–	dB	V_{DD} = 50 V, I_{DQ} = 1.2 A, P_{IN} = 10 dBm
Power Gain	P_G	15.05	16.0	-	dB	V_{DD} = 50 V, I_{DQ} = 1.2 A, P_{IN} = 38 dBm
Power Output	P_{OUT}	200	250	–	W	V_{DD} = 50 V, I_{DQ} = 1.2 A, P_{IN} = 38 dBm
Drain Efficiency[5]	η	60	69	–	%	V_{DD} = 50 V, I_{DQ} = 1.2 A, P_{IN} = 38 dBm
Output Mismatch Stress	VSWR	–	–	3 : 1	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 1.2 A, P_{OUT} = 200 W CW
Dynamic Characteristics[6]						
Input Capacitance	C_{GS}	–	29.3	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	7.3	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	0.61	–	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] Measured in CGHV40200PP-TB
[4] I_{DQ} of 1.2 A is by biasing each device at 0.6 A.
[5] Drain Efficiency = P_{OUT} / P_{DC}
[6] Capacitance values are for each side of the device.

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Typical Performance

Figure 1. - Gain and Return Losses vs Frequency measured in CGHV40200PP-TB
V_{DD} = 50 V, I_{DQ} = 1.2 A, Freq = 1.5 - 2.0 GHz

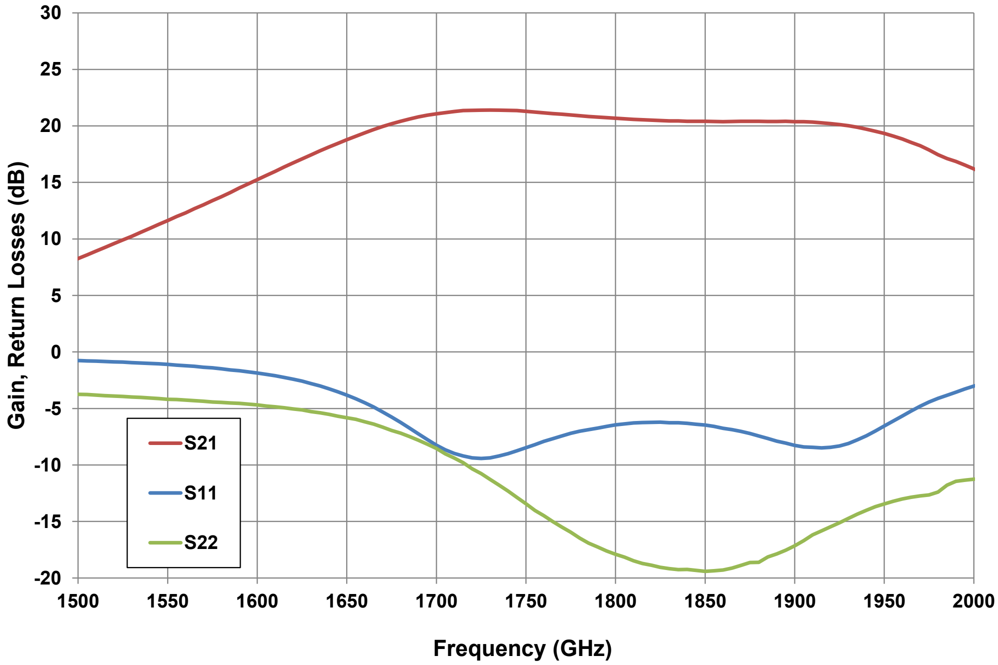
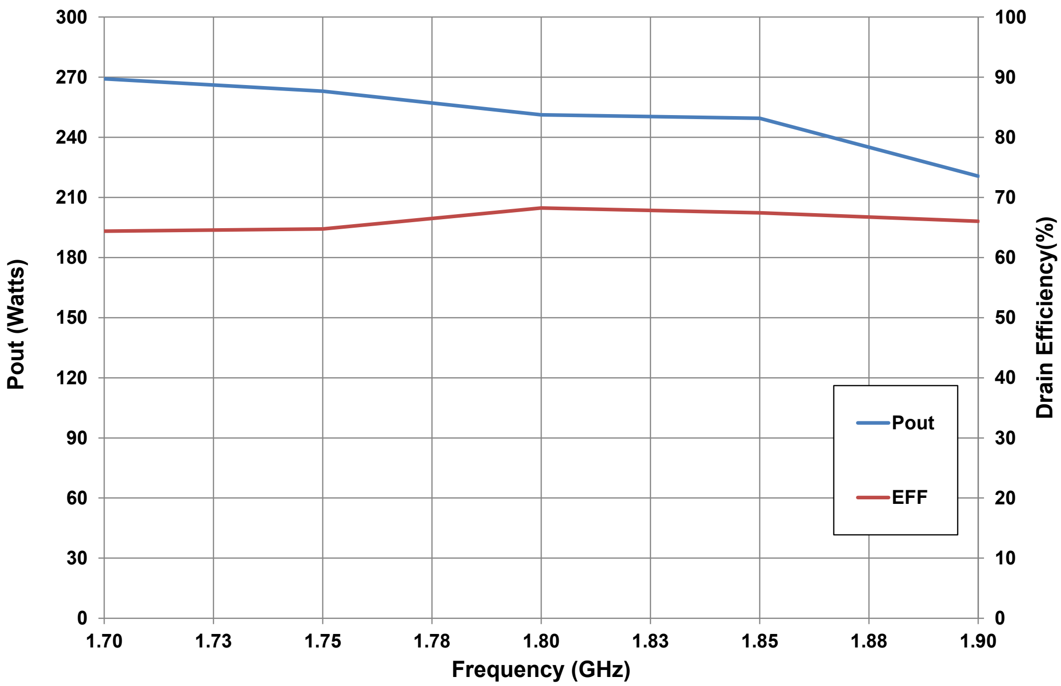


Figure 2. - Output Power and Drain Efficiency vs Frequency measured in CGHV40200PP-TB
CW Operation, V_{DD} = 50 V, I_{DQ} = 1.2 A, Output Power @ P_{IN} = 38 dBm



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Typical Performance

Figure 3. - Gain and Drain Efficiency vs Output Power measured in CGHV40200PP-TB
CW Operation, V_{DD} = 50 V, I_{DQ} = 1.2 A

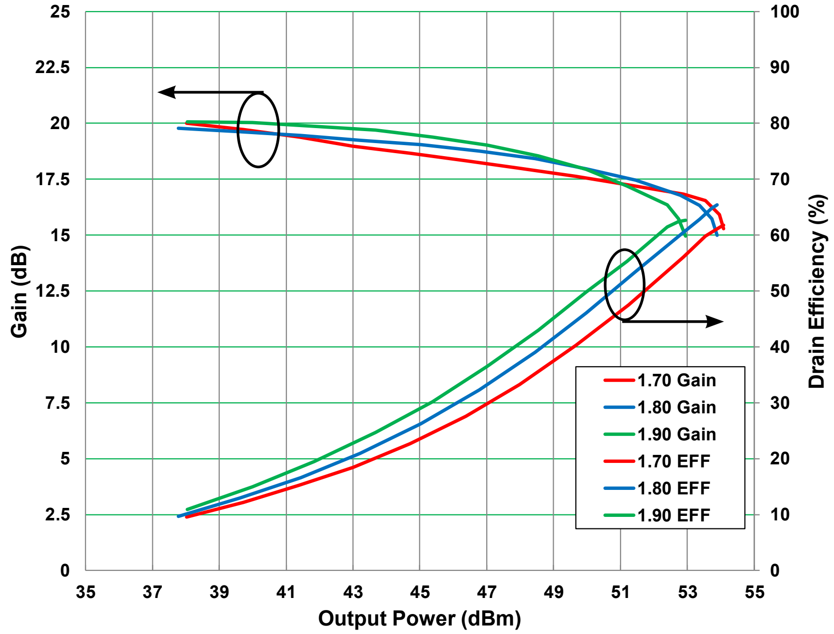
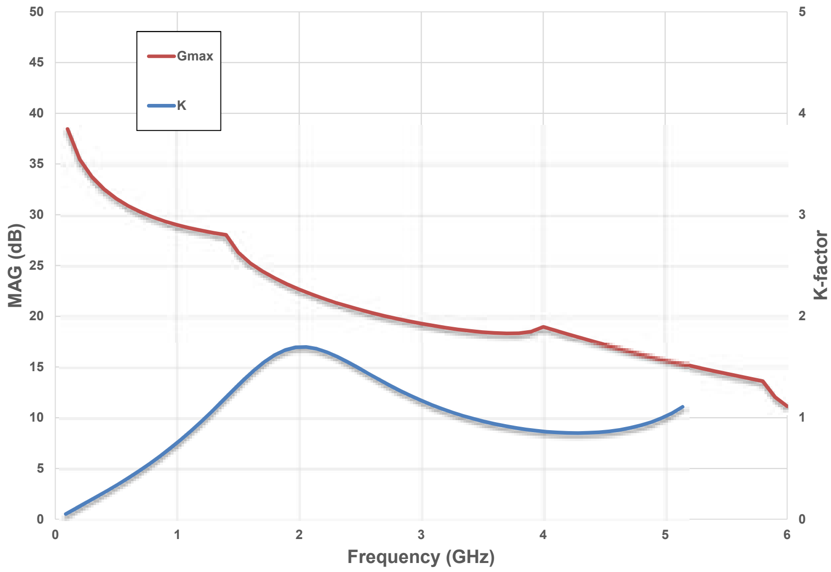


Figure 4. - Simulated Maximum Avaliable Gain and K-factor of the CGHV40200PP
V_{DD} = 50 V, I_{DQ} = 1.2 A



Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A > 250 V	JEDEC JESD22 A114-D
Charge Device Model	CDM	1 < 200 V	JEDEC JESD22 C101-C

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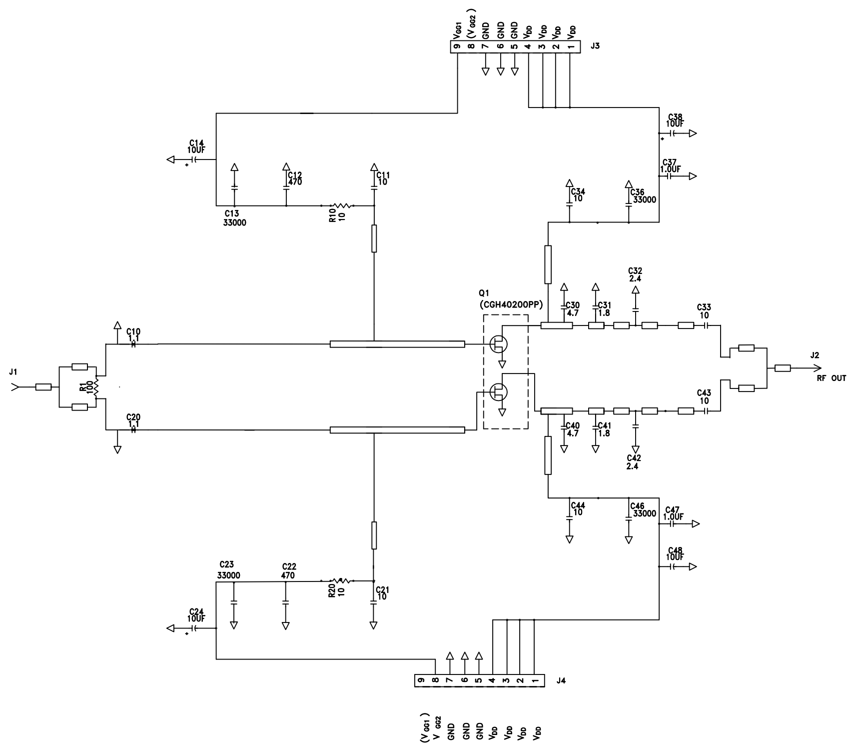
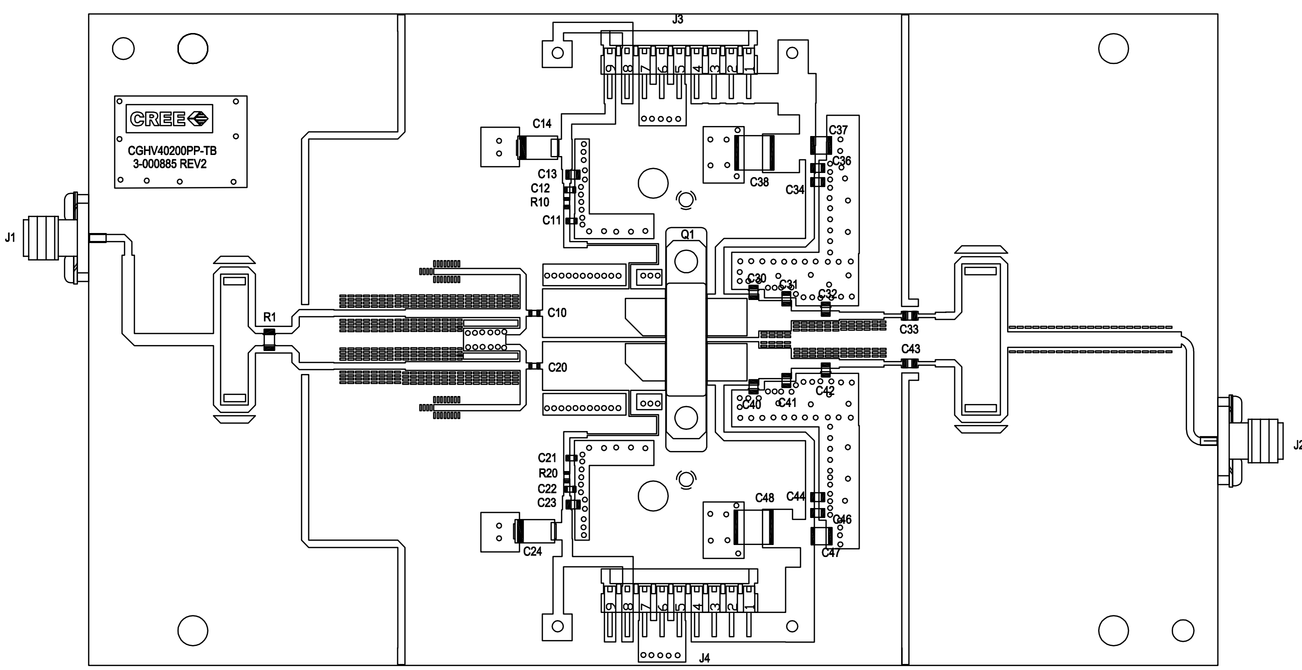
CGHV40200PP-TB Demonstration Amplifier Circuit Schematic



CGHV40200PP-TB Demonstration Amplifier Circuit Outline



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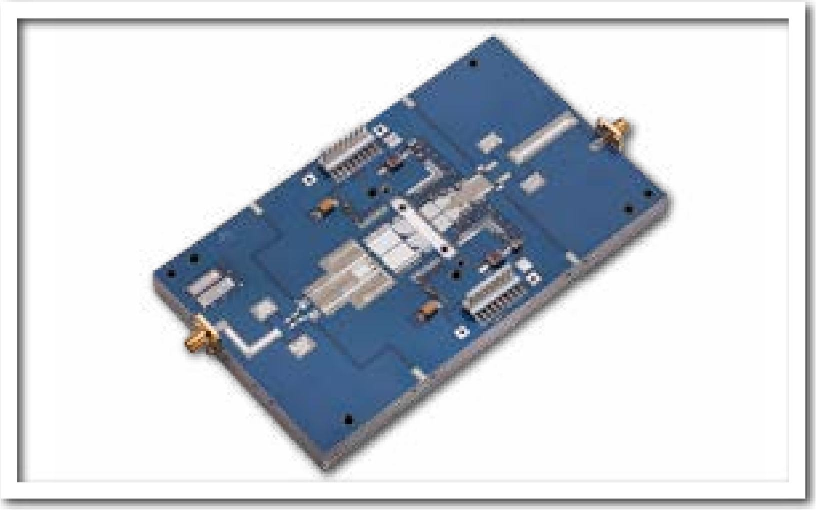
CGHV40200PP-TB Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES,1/8W,1206,1%,100 OHMS	1
R10,R20	RES, 1/16W, 0603, 1%, 10 Ohms	2
C10,C20	CAP, 1.1pF, +/-0.05 pF,0603, ATC600S	2
C11,C21	CAP, 10pF,+/-5%, 0603,ATC600S	2
C12,C22	CAP, 470PF, 5%, 100V,X7R 0603	2
C13,C23,C36,C46	CAP,33000PF, 0805,100V, X7R	4
C37,C47	CAP, 1.0UF, 100V, 10%, X7R, 1210	2
C38,C48	CAP, 33 UF, 20%, G CASE	2
C14,C24	CAP 10UF 16V TANTALUM, 2312	2
C30,C40	CAP, 4.7pF, +/-0.1pF, 250V, 0805,ATC600F	2
C31,C41	CAP, 1.8pF, +/-0.1pF, 250V, 0805,ATC600F	2
C32,C42	CAP, 2.4pF, +/-0.1pF, 250V, 0805,ATC600F	2
C33,C34,C43,C44	CAP, 10 PF +/- 5%,250V, 0805,ATC600F	4
-	PCB, Rogers HTC6035HTC , 0.020 THK, ER 3.6	1
J1,J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST	2
J3,J4	HEADER RT>PLZ .1CEN LK 9POS	2
Q1	CGHV40200PP	1

CGHV40200PP-TB Demonstration Amplifier Circuit



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Typical Performance -CGHV40200PP- AMP1 at L-Band CW

Figure 5. - Small Signal Gain and Return Losses vs Frequency measured in the CGHV40200PP Broadband Amplifier Circuit
V_{DD} = 50 V, I_{DQ} = 1.2 A

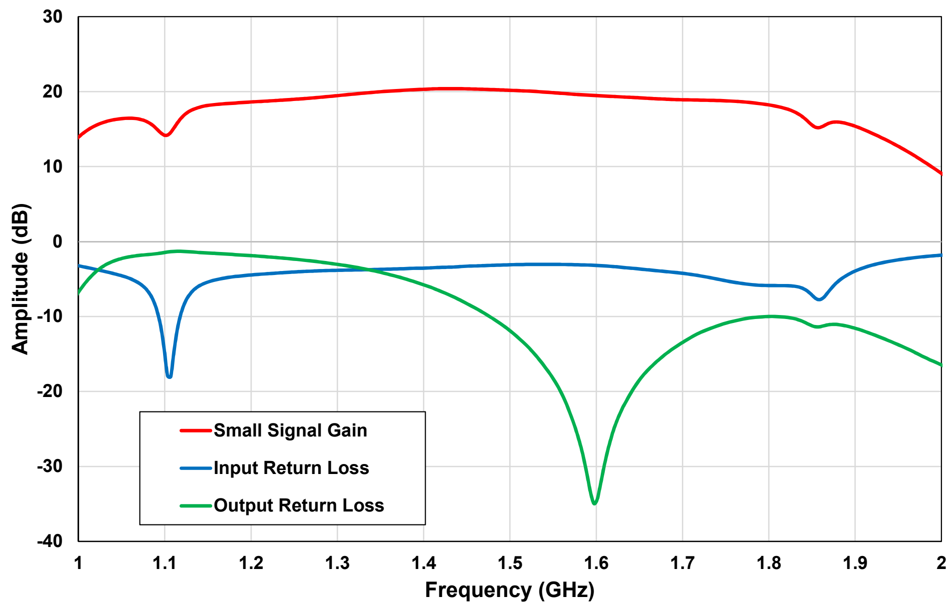
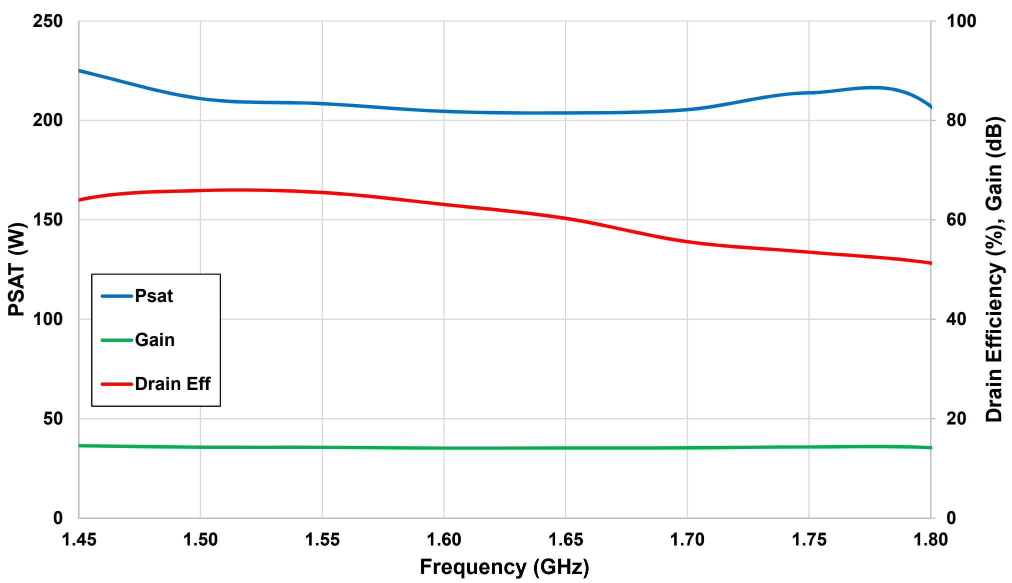


Figure 6. - Saturated Output Power Gain, and Drain Efficiency vs Frequency of the CGHV40200PP measured in the CGHV40200PP Broadband Amplifier Circuit
V_{DD} = 50V, I_{DQ} = 500mA



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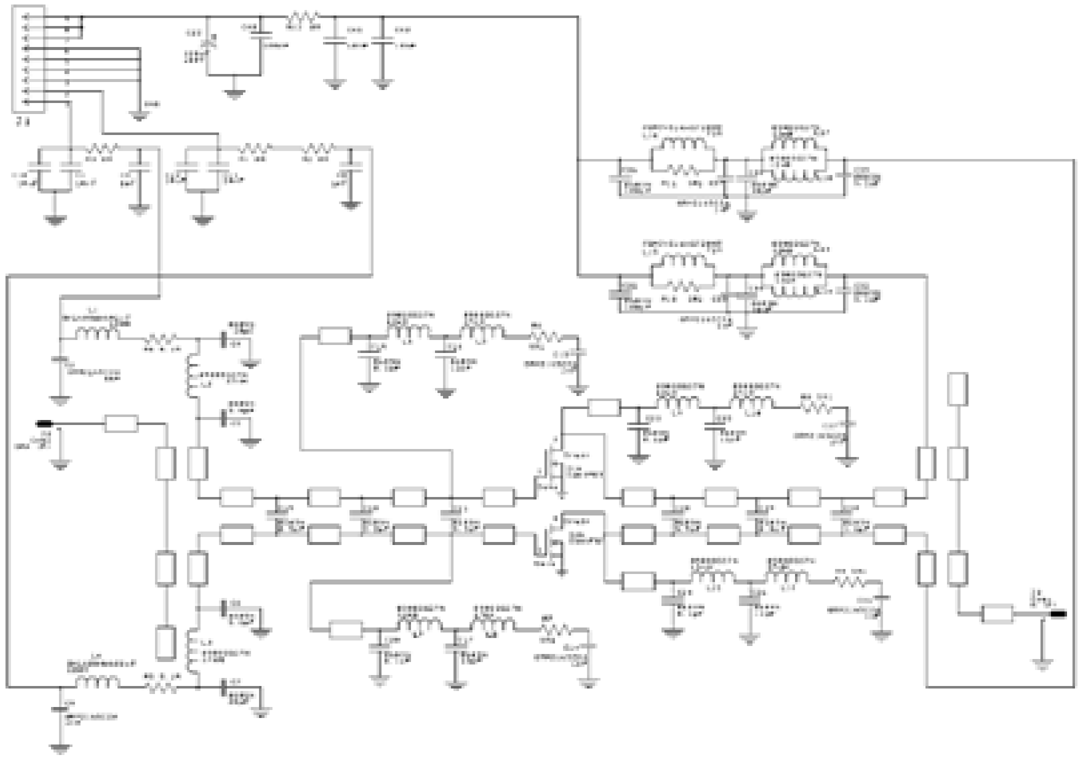
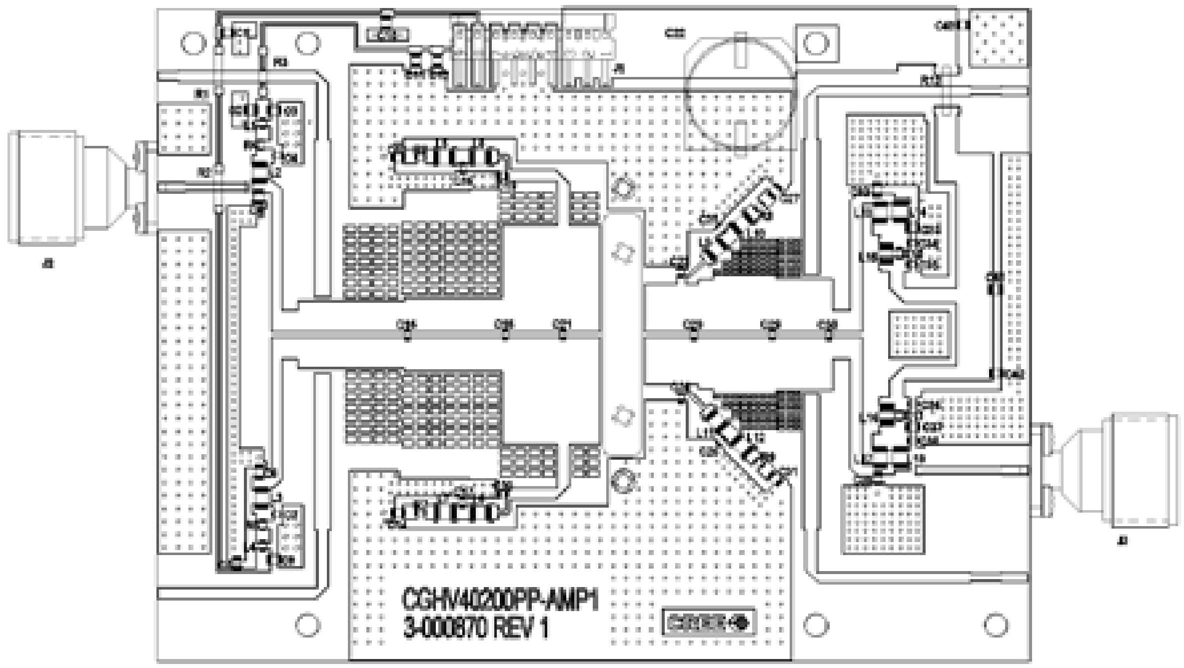
CGHV40200PP-AMP1 Demonstration Amplifier Circuit Schematic



CGHV40200PP-AMP1 Demonstration Amplifier Circuit Outline



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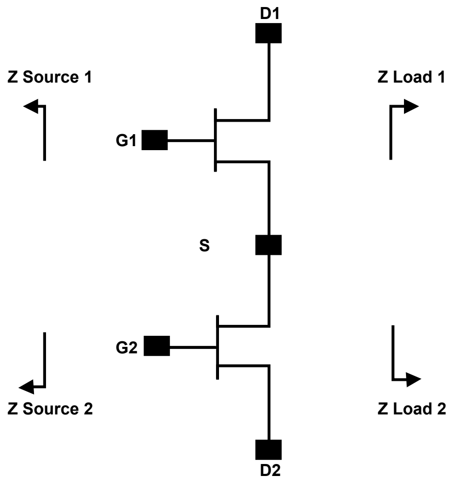
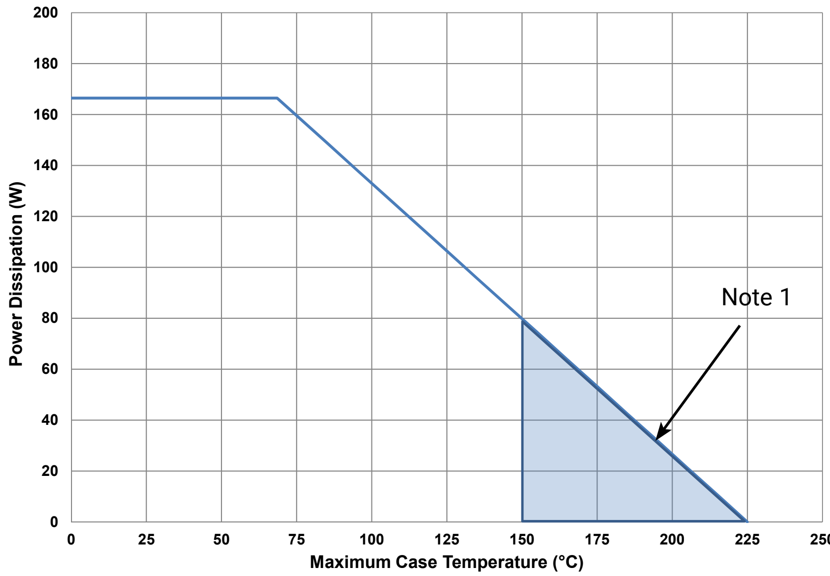
Simulated Source and Load Impedances



Frequency (MHz)	Z Source (1,2)	Z Load (1,2)
500	2.9 +j4.8	12.8 +j7.3
1000	0.8 +j1.5	9.1 +j5.1
1500	0.9 +-j0.6	5.5 +j3.8
2000	1.1 -j2.2	4.4 +j2.0
2500	1.8 -j4.0	3.8 +j0.5

Note 1. V_{DD} = 50 V, I_{DQ} = 2 x 0.6 A in the 440199 package.
Note 2. Optimized for power gain, P_{SAT} and PAE.
Note 3. When using this device at low frequency, series resistors should be used to maintain amplifier stability.

CGHV40200PP Power Dissipation De-rating Curve



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

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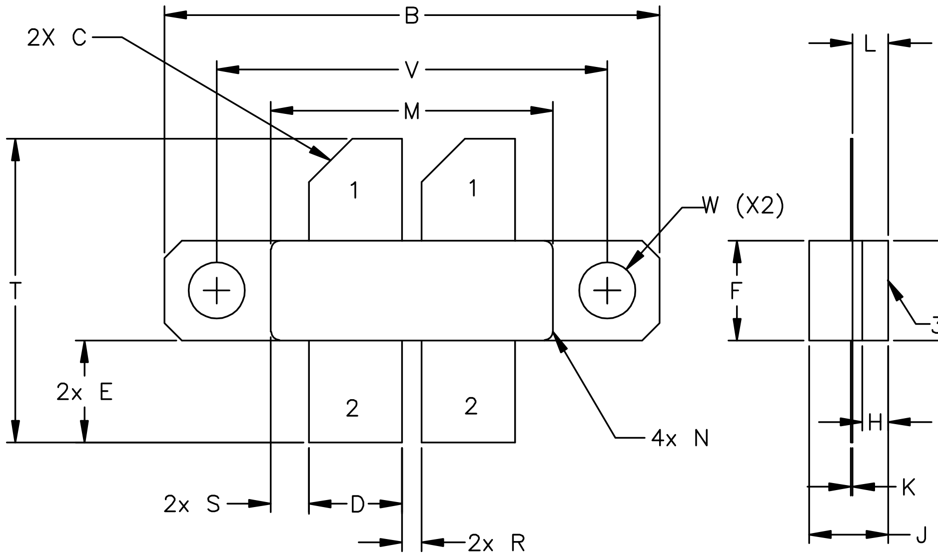
Product Dimensions CGHV40200PP (Package Type 440199)



NOTES:

1. DIMENSIONING AND TOLERANCING 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 PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.225	0.235	5.72	5.97
B	1.135	1.145	28.83	29.00
C	0.10 45° REF		2.54 45° REF	
D	0.210	0.220	5.33	5.59
E	0.230	0.240	5.84	6.00
F	0.225	0.235	5.71	5.97
H	0.055	0.065	1.40	1.65
J	0.151	0.171	3.84	4.34
K	0.003	0.006	0.08	0.15
L	0.075	0.085	1.91	2.16
M	0.643	0.657	16.30	16.70
N	R.020 REF		R0.51 REF	
R	0.040	0.050	1.00	1.27
S	0.083	0.093	2.10	2.36
T	0.680	0.720	17.30	18.30
V	0.895	0.905	22.70	22.98
W	ø.130		ø 3.30	

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

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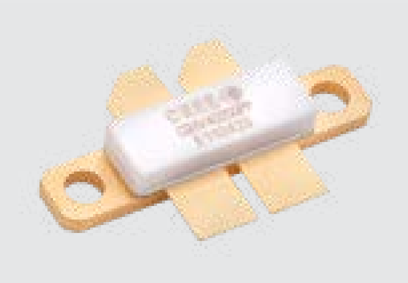
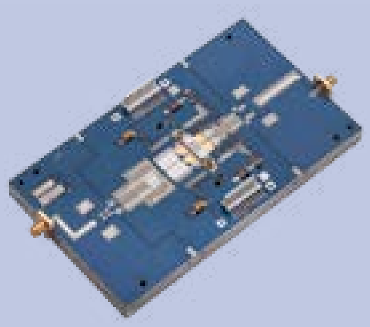
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV40200PP	GaN HEMT	Each	
CGHV40200PP-AMP1	Test board with GaN HEMT installed	Each	

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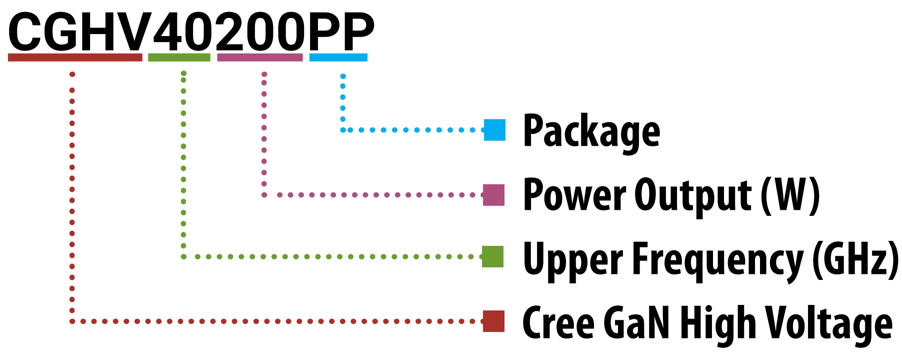
Part Number System



Parameter	Value	Units
Upper Frequency[1]	4.0	GHz
Power Output	200	W
Package	Push Pill	-

Table 1.

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

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

Table 2.

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