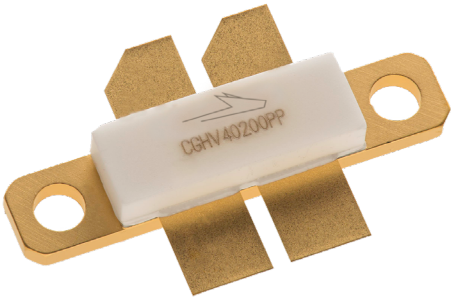
CGHV40200PP

200 W, 50 V, GaN HEMT

Description

Wolfspeed'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

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

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	%

Large Signal Models Available for ADS and MWO

RoHS compliant

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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	V	25°C
Storage Temperature	T_{STG}	-65, +150	°C	
Operating Junction Temperature	T_J	225	°C	
Maximum Forward Gate Current[1]	I_{GMAX}	41.6	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]	$R_{\theta JC}$	0.94	°C/W	85°C
Case Operating Temperature[3, 4]	T_C	-40, +70	°C	

Notes:
[1] Current limit for long term, reliable operation per side of the device
[2] Refer to the Application Note on soldering at wolfspeed.com/rf/document-library
[3] CGHV40200PP at P_{DISS} = 166 W
[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	-3.0	-2.3	V_{DC}	V_{DS} = 10 V, I_D = 41.6 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}	27.0	38.7	—	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 = 41.6 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	G_P	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} = 50 V, I_{DQ} = 1.2 A, P_{OUT} = 200 W CW
Dynamic Characteristics						
Input Capacitance	C_{GS}	—	29.3	—	pF	V_{DS} = 28 V, V_{GS} = -8 V, ƒ = 1 MHz
Output Capacitance	C_{DS}	—	7.3	—	pF	V_{DS} = 28 V, V_{GS} = -8 V, ƒ = 1 MHz
Feedback Capacitance	C_{GD}	—	0.61	—	pF	V_{DS} = 28 V, V_{GS} = -8 V, ƒ = 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}
[5] Capacitance values are for each side of the device

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Typical Performance

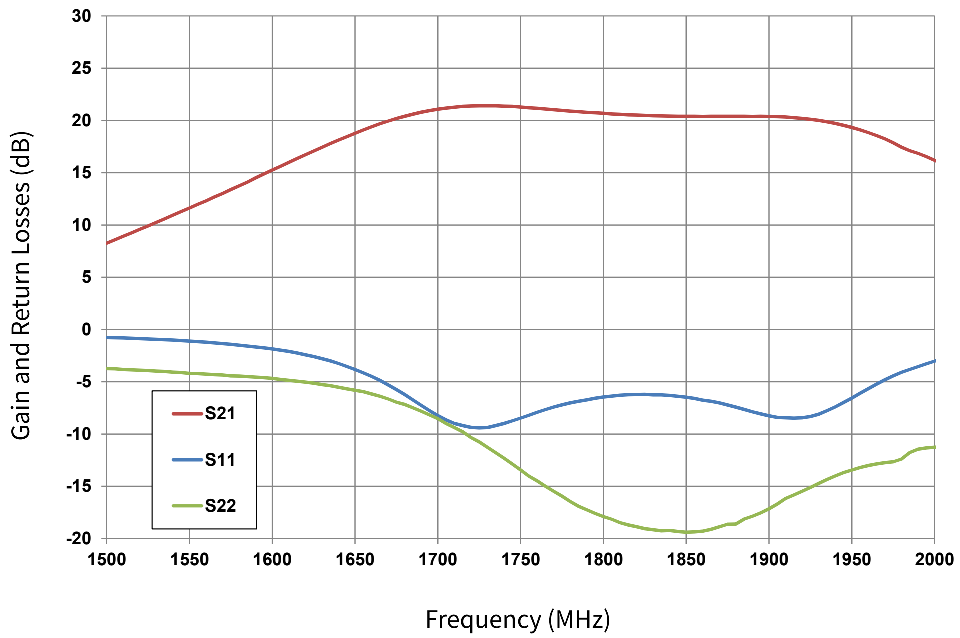

Figure 1. Gain and Return Losses vs Frequency measured in CGHV40200PP-TB
V_{DD} = 50 V, I_{DQ} = 1.2 A, f = 1500 - 2000 MHz

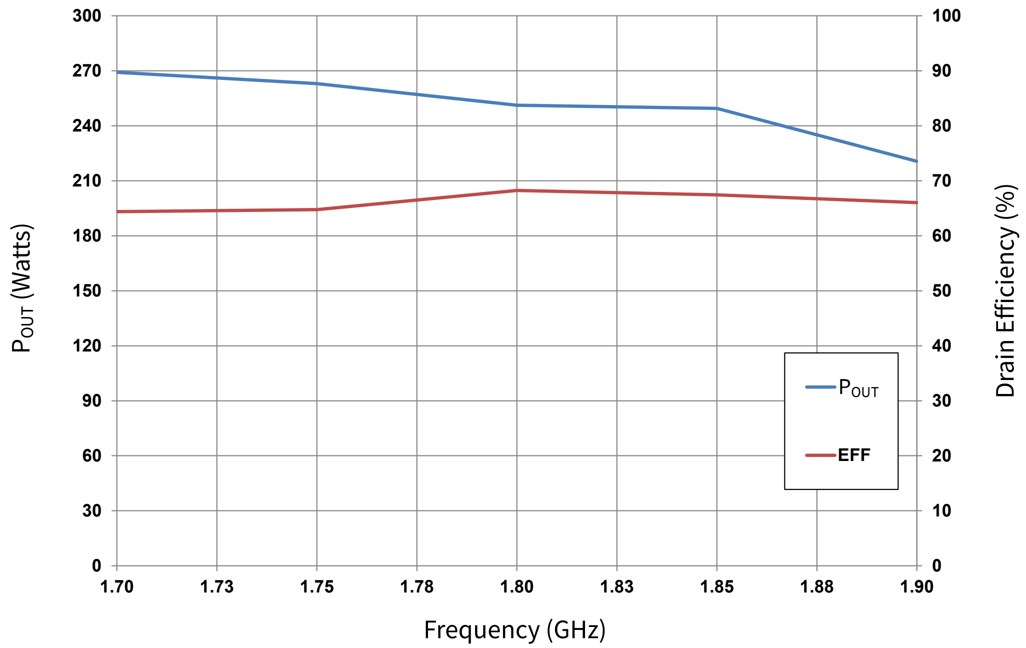

Figure 2. Output Power and Drain Efficiency vs Frequency measured in CGHV40200PP-TB
CW Operation, V_{DD} = 50 V, I_{DQ} = 1.2 A, Output Power @ P_{IN} = 38 dBm

Typical Performance

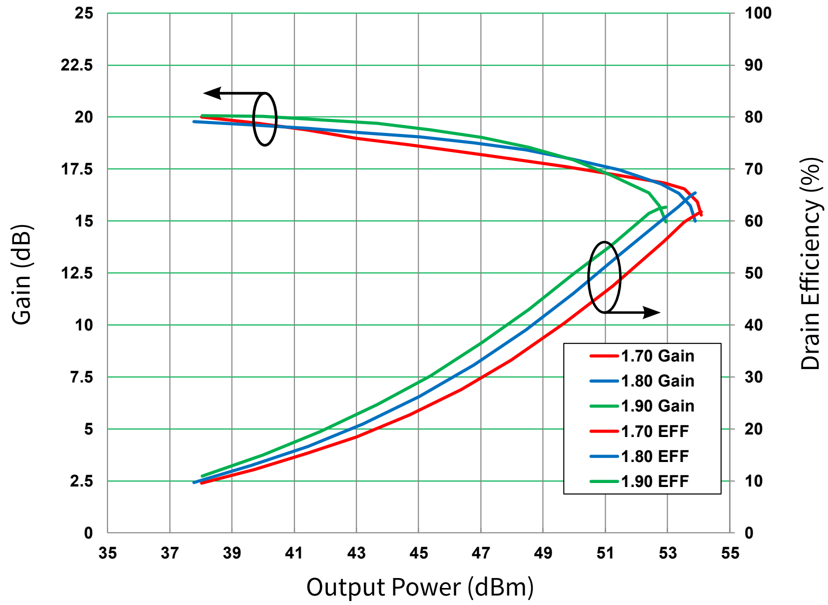

Figure 3. Gain and Drain Efficiency vs Output Power measured in CGHV40200PP-TB
CW Operation, V_{DD} = 50 V, I_{DQ} = 1.2 A

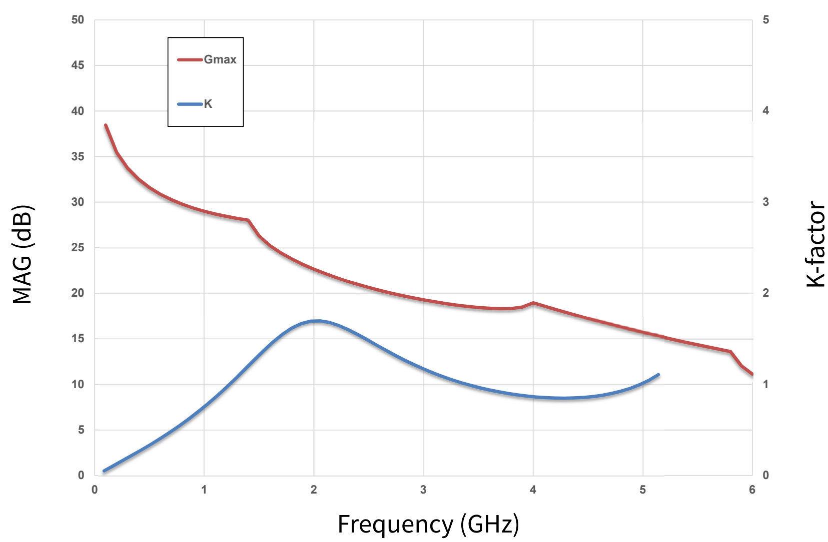

Figure 4. Simulated Maximum Avaliable Gain and K-factor of the CGHV40200PP
V_{DD} = 50 V, I_{DQ} = 1.2 A

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	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

CGHV40200PP-AMP1 Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1, R2	RES, 1/4W, 1206 1%, 0 OHM	2
R5, R6, R7, R11, R12, R13	RES, 1/16W, 0603, 1%, 5.1 Ohms	6
R3, R4, R9, R10	RES 5.1 OHM 1/8W 5% 0805 SMD	4
R15, R16, R17, R18	RES SMD 10 OHM 1% 2W 2512	4
R8, R14	RES SMD 150 OHM 5% 1W 2512	2
C48, C49	CAP, 0.1pF, +/- 0.05pF, 0805, ATC, 600F	2
C16	CAP, 0.8pF, +/-0.05pF, 0805, ATC	1
C27	CAP, 1.2pF, +/-0.1pF, 0603, ATC	1
C24	CAP, 1.2pF, +/-0.1pF, 0805, ATC	1
C15	CAP, 1.0pF, +/-0.1pF, 0603, ATC	1
C26	CAP, 1.5pF,+/-0.1pF, 0603, ATC	1
C25	CAP, 2.0pF, +/-0.1pF, 0805, ATC	1
C17	CAP, 3.9pF, +/-0.25pF, 0805, ATC	1
C28, C29, C36, C37, C42, C46	CAP, 5.1pF, +/-0.05pF, 0805, ATC600F	4
C5, C6, C38, C39	CAP, 5.6pF, +/- 0.1pF, 0805, ATC 600F	4
C4, C7, C31, C35	CAP, 20pF, +/- 5% 250V 0805, ATC600F	4
C32, C33, C44, C47	CAP, 100pF, +/- 5%, 250V, 0805, ATC 600F	4
C2, C3, C8, C9, C13, C18, C30, C34, C40, C41, C43, C45	CAP, 1000pF, +/-10%, 0805, X7R, 100V, TEMP STBL	12
C1, C11, C14, C19, C22, C23	CAP, 10000pF, +/-10%, 0805, X7R, 100V, TEMP STBL	6
C21	CAP, 0.1µF, +/-10%, 250V, 1206, X7R	1
C10, C12	CAP CER 10µF 25V X7R 1206	2
C20	CAP, 330µF, +/-20%, 100V, ELECTROLYTIC, CASE SIZE K16	1
L6, L7, L9, L10, L12, L13	IND, 12NH, 2%, 0908SQ-12NGL	6
L2, L3	IND, 27NH, 2%, 0908SQ-27NGL	2
L11	CABLE, 18 AWG, 4.2”	1
L1, L4	FERRITE BEAD 600 OHM 0603 1LN	2
L5, L8	FERRITE BEAD 72 OHM 1806 1LN	2
J2, J3	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST	2
J1	HEADER RT>PLZ .1CEN LK 9POS	1
J4, J5	CONN SMA JACK STR 50 OHM SMD	2
	PCB, Rogers 6035HTC 0.020” THK, CGHV40200PP 1.35-1.85 GHz	1
	BASEPLATE, AL, 4.80 X 3.60 X 0.49, ALTERNATE HOLE PATTERN	1
	2-56 SOC HD SCREW 1/4 SS	4
	#2 SPLIT LOCKWASHER SS	4
	CGHV40200PP	1

CGHV40200PP Typical Performance

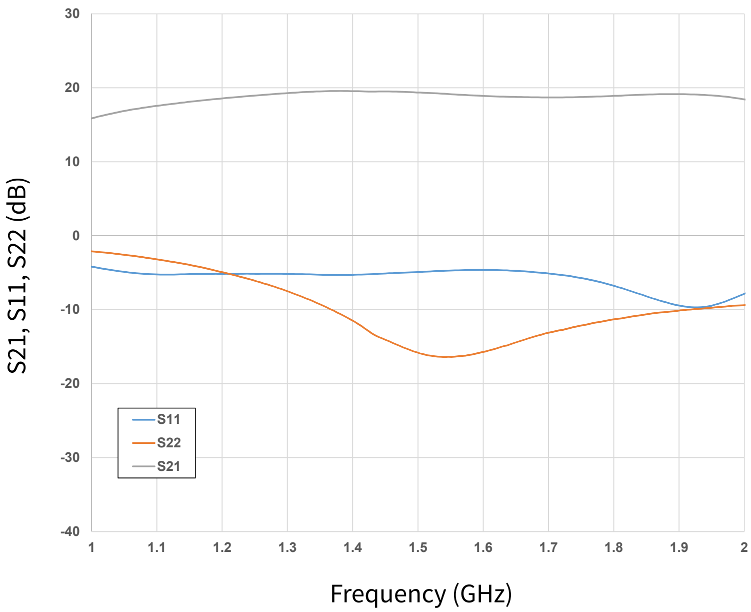

Figure 5. Small Signal Gain and Return Losses vs Frequency measured in the CGHV40200PP-AMP1 Broadband Amplifier Circuit
V_{DD} = 50 V, I_{DQ} = 1.2 A

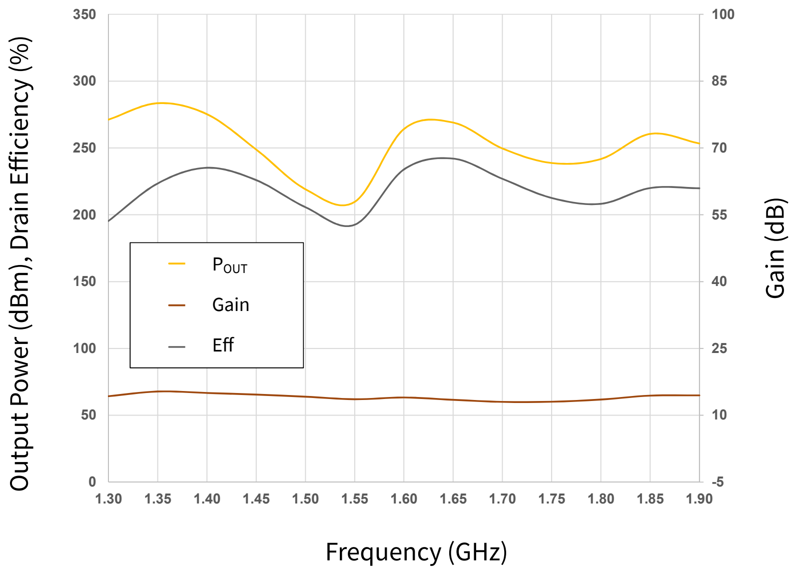

Figure 6. Saturated Output Power Gain, and Drain Efficiency vs Frequency of the CGHV40200PP measured in the CGHV40200PP-AMP1 Broadband Amplifier Circuit
V_{DD} = 50V, I_{DQ} = 1 A, CW, P_{SAT}, I_G = 0 mA

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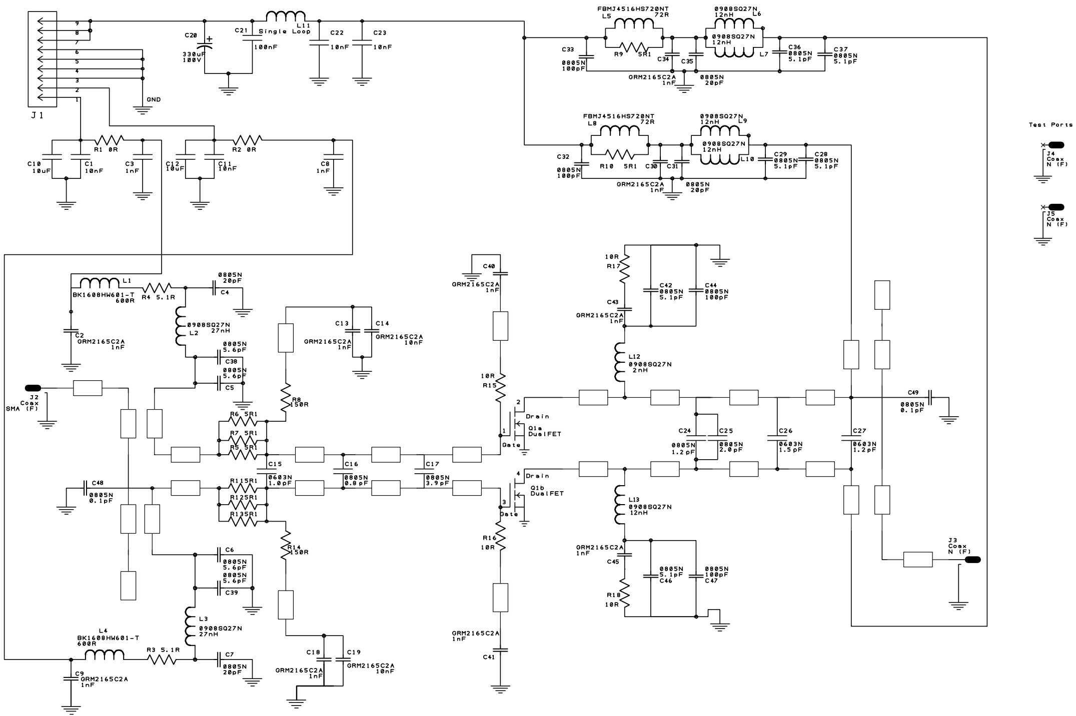
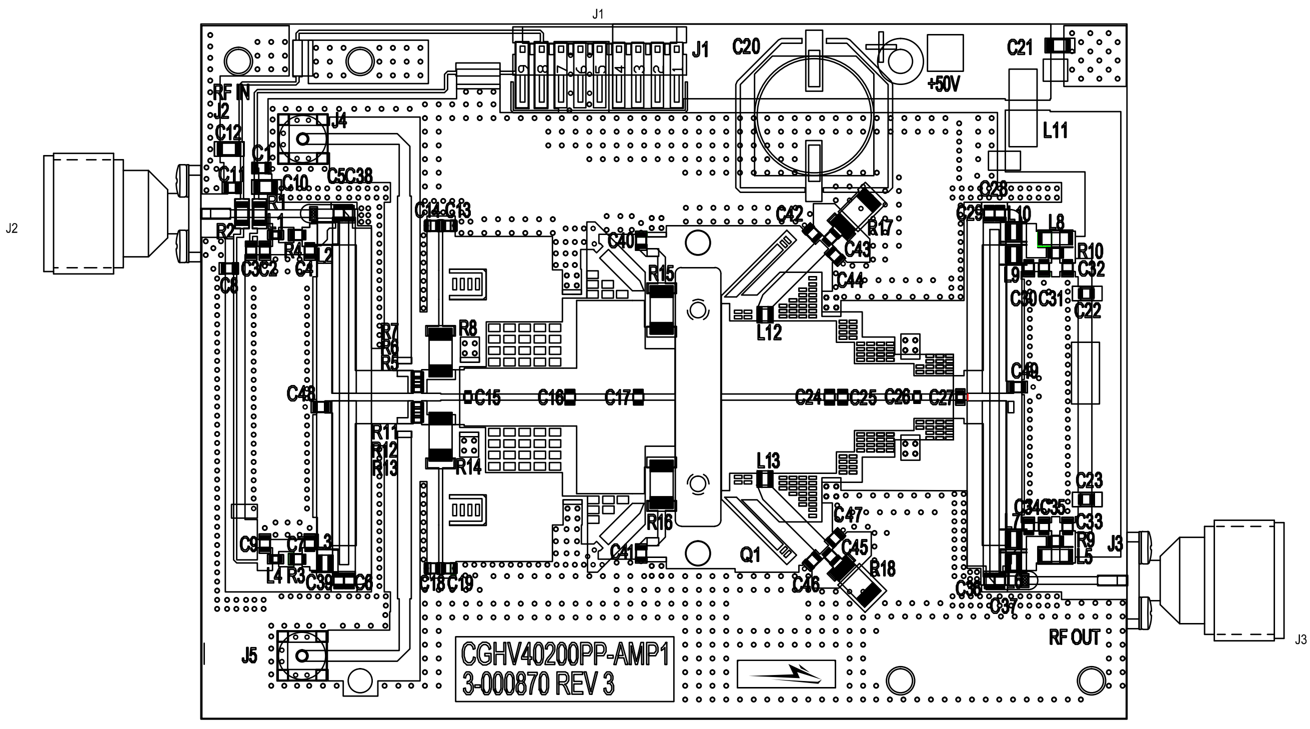
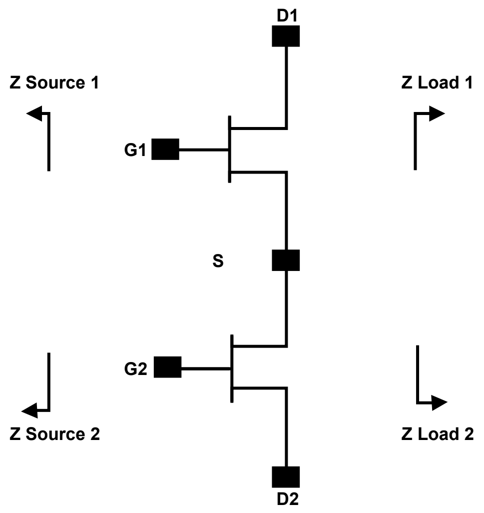
CGHV40200PP-AMP1 Demonstration Amplifier Circuit Schematic



CGHV40200PP-AMP1 Demonstration Amplifier Circuit Outline



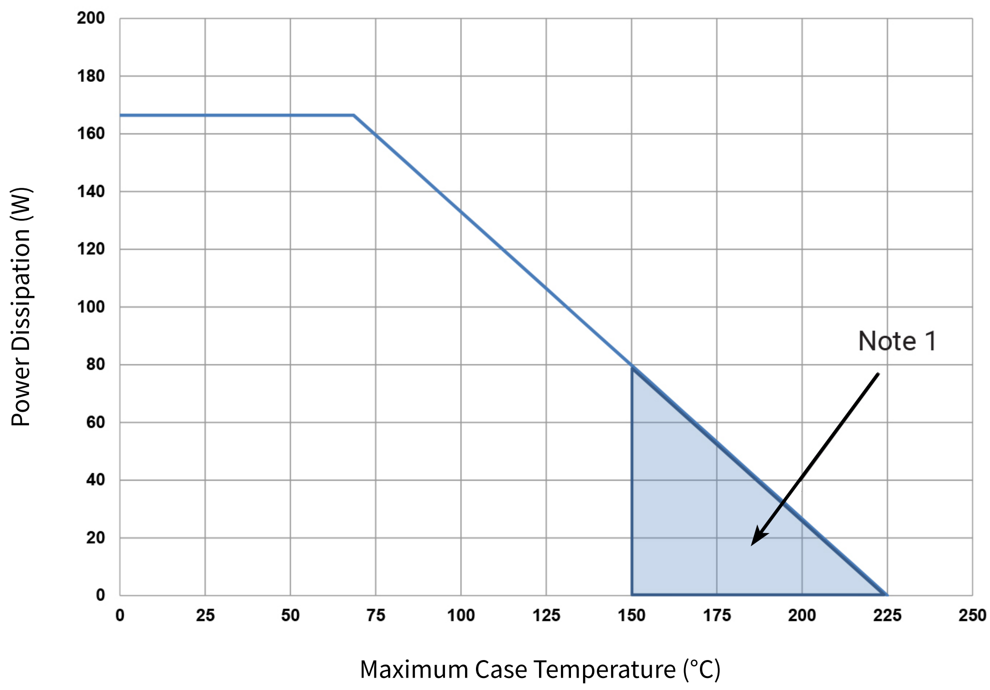
Simulated Source and Load Impedances



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

Notes:
[1] V_{DD} = 50 V, I_{DQ} = 2 x 0.6 A in the 440199 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

CGHV40200PP Power Dissipation De-rating Curve



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

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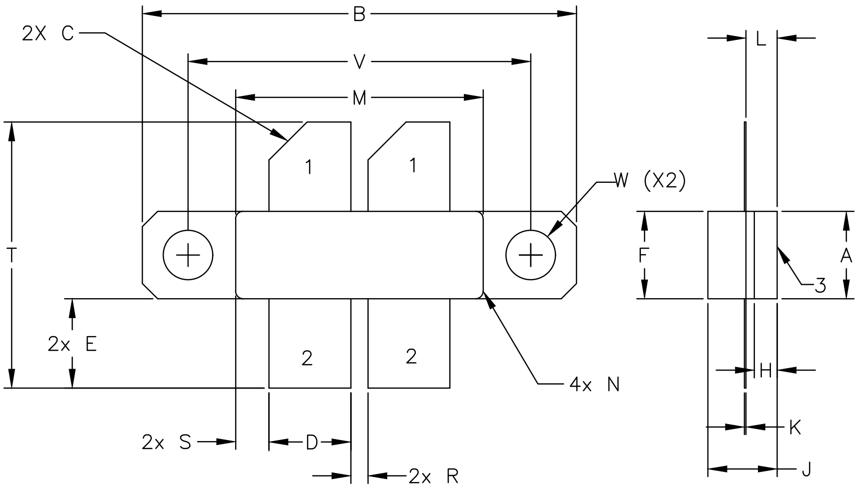
Product Dimensions CGHV40200PP (Package Type 440199)



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	0.174	0.208	3.87	4.37
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.010 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	

Part Number System

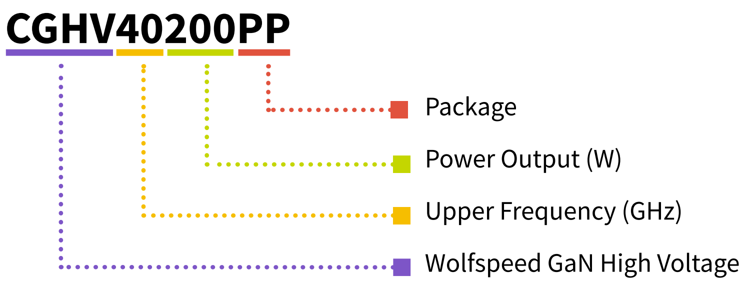


Table 1.

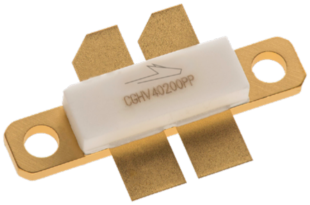
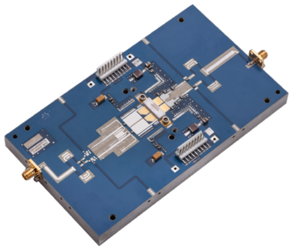
Parameter	Value	Units
Upper Frequency[1]	2.5	GHz
Power Output	200	W
Package	Push Pill	—

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
CGHV40200PP	GaN HEMT	Each	
CGHV40200PP-AMP1	Test board with GaN HEMT installed	Each	

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