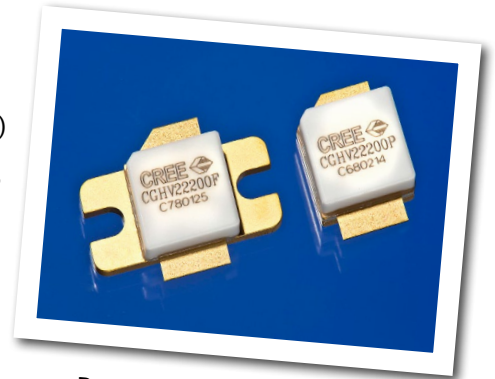


CGHV22200

200 W, 1800-2200 MHz, GaN HEMT for LTE

Cree's CGHV22200 is a gallium nitride (GaN) high electron mobility transistor (HEMT) is designed specifically for high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV22200F ideal for 1.8 - 2.2 GHz LTE, 4G Telecom and BWA amplifier applications. The transistor is input matched and supplied in a ceramic/metal flange package.



Package Type: 440162 and 440161
PN: CGHV22200F and CGHV22200P

Typical Performance Over 1.8 - 2.2 GHz ($T_c = 25^\circ\text{C}$) of Demonstration Amplifier

Parameter	1.8 GHz	2.0 GHz	2.2 GHz	Units
Gain @ 47 dBm	16.6	19.2	18.1	dB
ACLR @ 47 dBm	-37.4	-37.4	-35.6	dBc
Drain Efficiency @ 47 dBm	31.5	31.9	34.8	%

Note:

Measured in the CGHV22200-AMP amplifier circuit, under WCDMA 3GPP test model 1, 64 DPCH, 45% clipping, PAR = 7.5 dB @ 0.01% Probability on CCDF. $I_{DS} = 1.0\text{ A}$

Features



- 1.8 - 2.2 GHz Operation
- 18 dB Gain
- -35 dBc ACLR at 50 W P_{AVE}
- 31-35 % Efficiency at 50 W P_{AVE}
- High Degree of DPD Correction Can be Applied

Large Signal Models Available for ADS and MWO



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 ³	T_J	225	°C	
Maximum Forward Gate Current	I_{GMAX}	32	mA	25°C
Maximum Drain Current ¹	I_{DMAX}	12	A	25°C
Soldering Temperature ²	T_S	245	°C	
Screw Torque	τ	80	in-oz	
Thermal Resistance, Junction to Case ³	$R_{\theta JC}$	1.22	°C/W	85°C, $P_{DISS} = 96$ W
Thermal Resistance, Junction to Case ⁴	$R_{\theta JC}$	1.54	°C/W	85°C, $P_{DISS} = 96$ W
Case Operating Temperature ⁵	T_C	-40, +150	°C	

Note:

¹ Current limit for long term, reliable operation.

² Refer to the Application Note on soldering at <http://www.cree.com/rf/document-library>

³ Measured for the CGHV22200P

⁴ Measured for the CGHV22200F

⁵ See also, the Power Dissipation De-rating Curve on Page 6.

Electrical Characteristics ($T_C = 25^\circ\text{C}$)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics¹						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V_{DC}	$V_{DS} = 10$ V, $I_D = 32$ mA
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	V_{DC}	$V_{DS} = 50$ V, $I_D = 1.0$ A
Saturated Drain Current ²	I_{DS}	24	28.8	-	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	V_{BR}	150	-	-	V_{DC}	$V_{GS} = -8$ V, $I_D = 32$ mA
RF Characteristics³ ($T_C = 25^\circ\text{C}$, $F_0 = 2.17$ GHz unless otherwise noted)						
Saturated Output Power ^{3,4}	P_{SAT}	-	240	-	W	$V_{DD} = 50$ V, $I_{DQ} = 1.0$ A
Pulsed Drain Efficiency ³	η	-	65	-	%	$V_{DD} = 50$ V, $I_{DQ} = 1.0$ A, $P_{OUT} = P_{SAT}$
Gain ⁶	G	-	18.0	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 1.0$ A, $P_{OUT} = 47$ dBm
WCDMA Linearity ⁶	ACLR	-	-36.7	-	dBc	$V_{DD} = 50$ V, $I_{DQ} = 1.0$ A, $P_{OUT} = 47$ dBm
Drain Efficiency ⁶	η	-	34.5	-	%	$V_{DD} = 50$ V, $I_{DQ} = 1.0$ A, $P_{OUT} = 47$ dBm
Output Mismatch Stress ³	VSWR	-	-	10 : 1	Ψ	No damage at all phase angles, $V_{DD} = 50$ V, $I_{DQ} = 1.0$ A, $P_{OUT} = 200$ W Pulsed
Dynamic Characteristics						
Input Capacitance ⁷	C_{GS}	-	97	-	pF	$V_{DS} = 50$ V, $V_{GS} = -8$ V, $f = 1$ MHz
Output Capacitance ⁷	C_{DS}	-	13.4	-	pF	$V_{DS} = 50$ V, $V_{GS} = -8$ V, $f = 1$ MHz
Feedback Capacitance	C_{GD}	-	0.94	-	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 Pulse Width = 100 μ S, Duty Cycle = 10%

⁴ P_{SAT} is defined as $I_G = 3$ mA peak.

⁵ Measured in CGHV22200-AMP

⁶ Single Carrier WCDMA, 3GPP Test Model 1, 64 DPCH, 45% Clipping, PAR = 7.5 dB @ 0.01% Probability on CCDF.

⁷ Includes package and internal matching components.

Typical Performance

Figure 1. - Small Signal Gain and Return Losses vs Frequency for the CGHV22200 measured in CGHV22200-AMP Amplifier Circuit
 $V_{DD} = 50\text{ V}, I_{DQ} = 1.0\text{ A}$

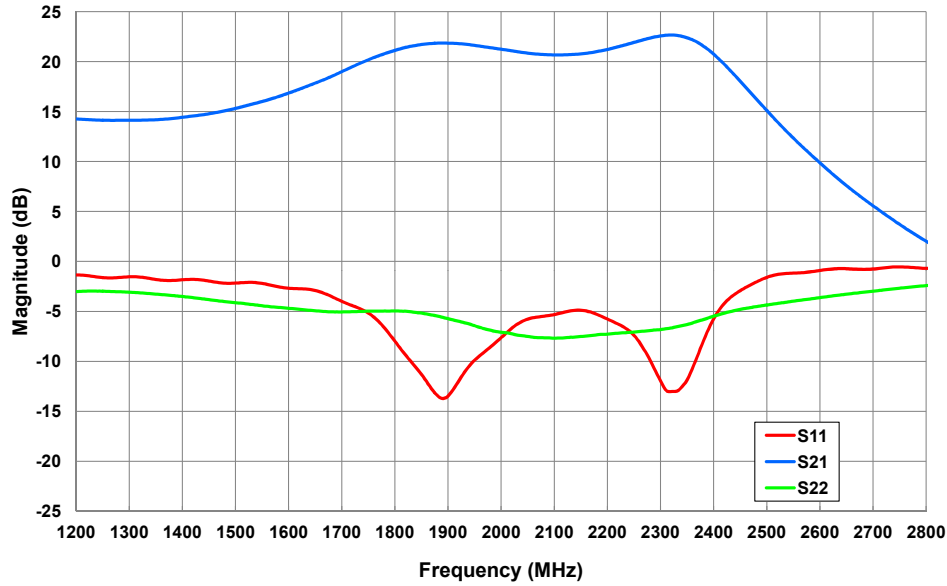
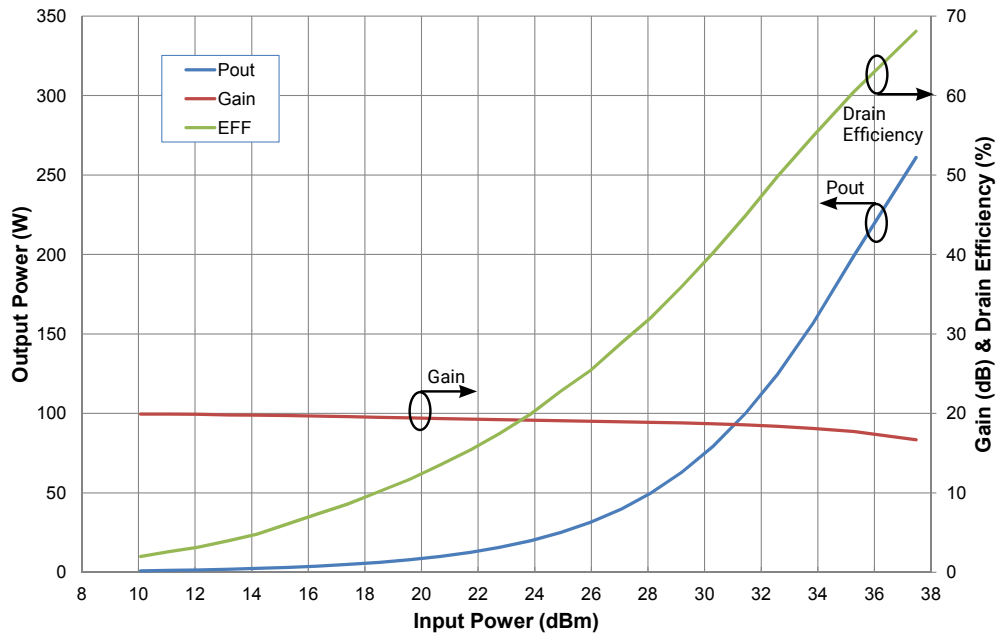


Figure 2. - Typical Gain and Drain Efficiency vs Input Power of the CGHV22200 measured in CGHV22200-AMP Amplifier Circuit.
 $V_{DS} = 50\text{ V}, I_{DQ} = 1.0\text{ A}, \text{Freq} = 2.1\text{ GHz}, \text{Pulse Width} = 100\text{ }\mu\text{s}, \text{Duty Cycle} = 10\%$



Typical Performance

Figure 3. - Typical WCDMA Transfer Characteristics
 $V_{DD} = 50\text{ V}$, $I_{DS} = 1.0\text{ A}$, 1c WCDMA, PAR = 7.5 dB

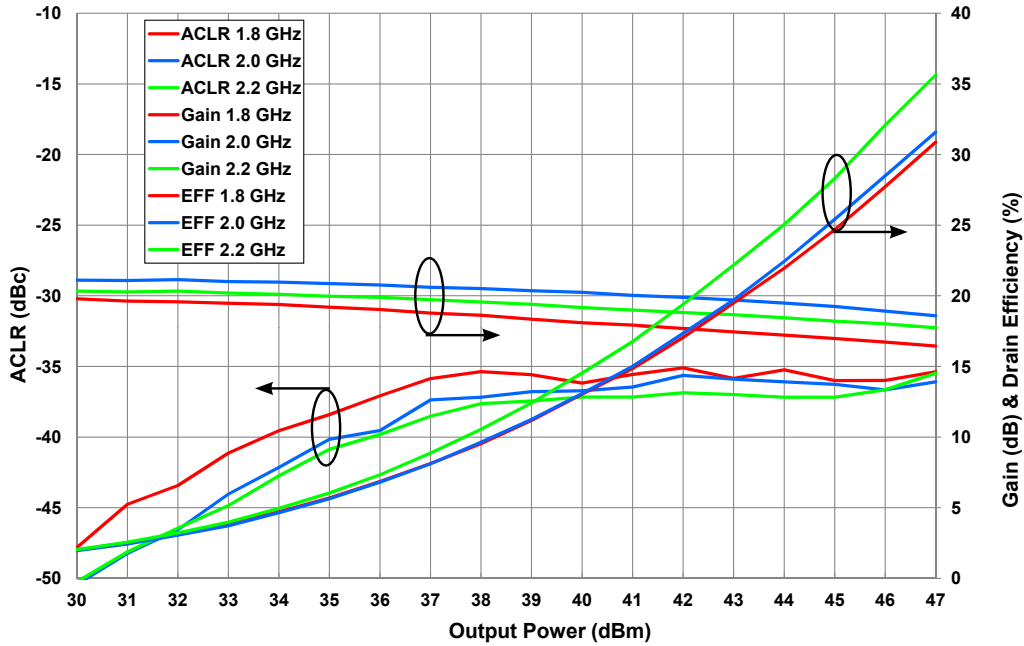
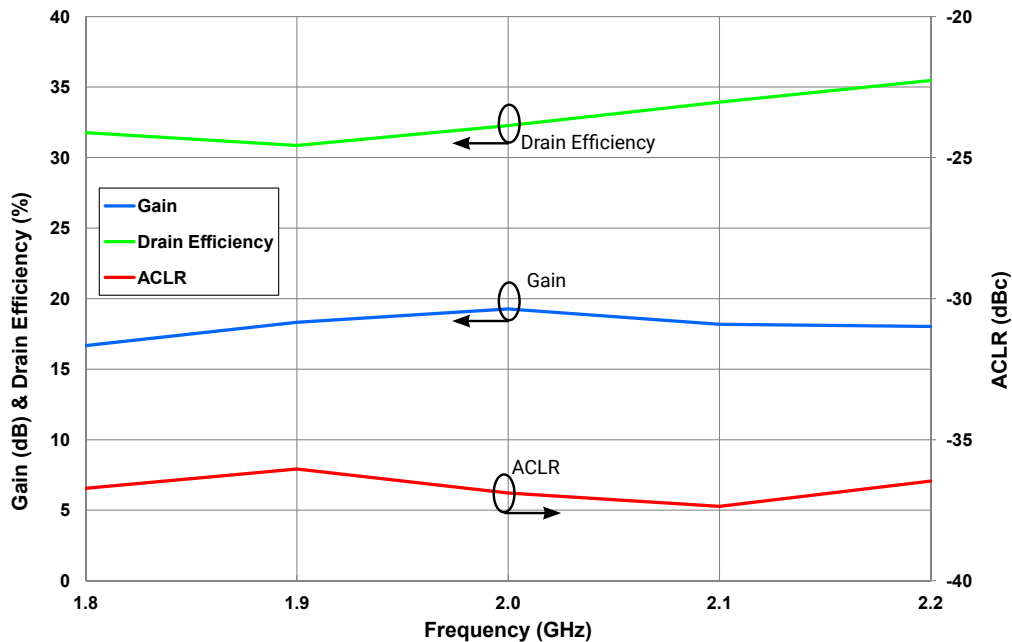


Figure 4. - Typical Gain, Drain Efficiency and ACLR vs Frequency
of the CGHV22200 measured in CGHV22200-AMP Amplifier Circuit
 $V_{DD} = 50\text{ V}$, $I_{DS} = 1.0\text{ A}$, $P_{AVE} = 50\text{ W}$, 1c WCDMA, PAR = 7.5 dB



Typical Performance

Figure 5. - CGHV22200 Spectral Mask at $P_{AVE} = 47$ dBm with and without DPD
 $V_{DD} = 50$, $I_{DQ} = 1.0$ A, Freq=2.14 GHz, 1 C WCDMA 7.5 PAR

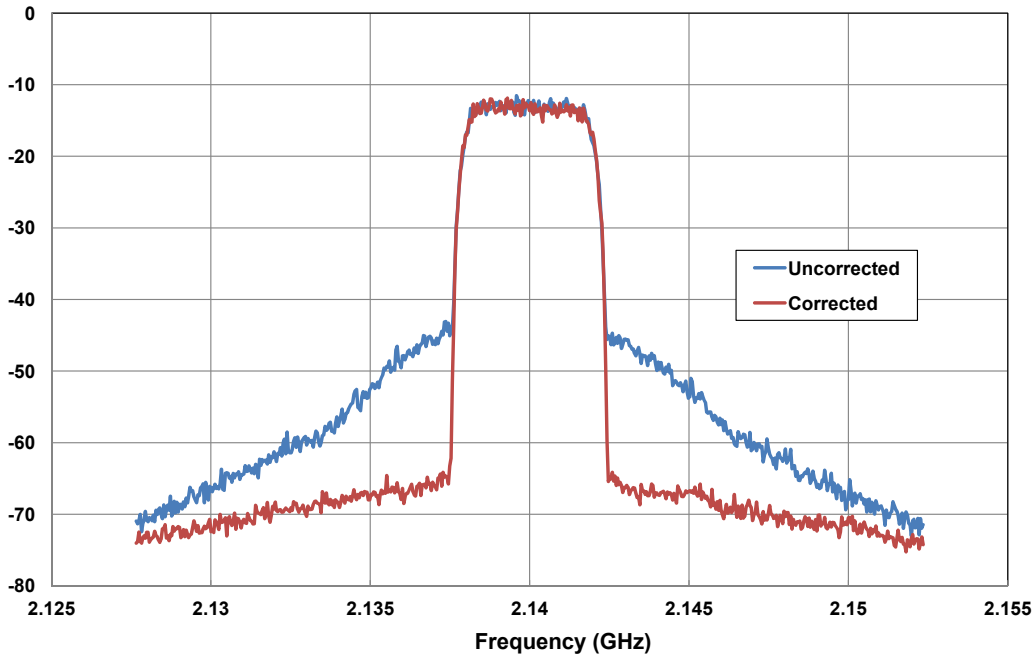
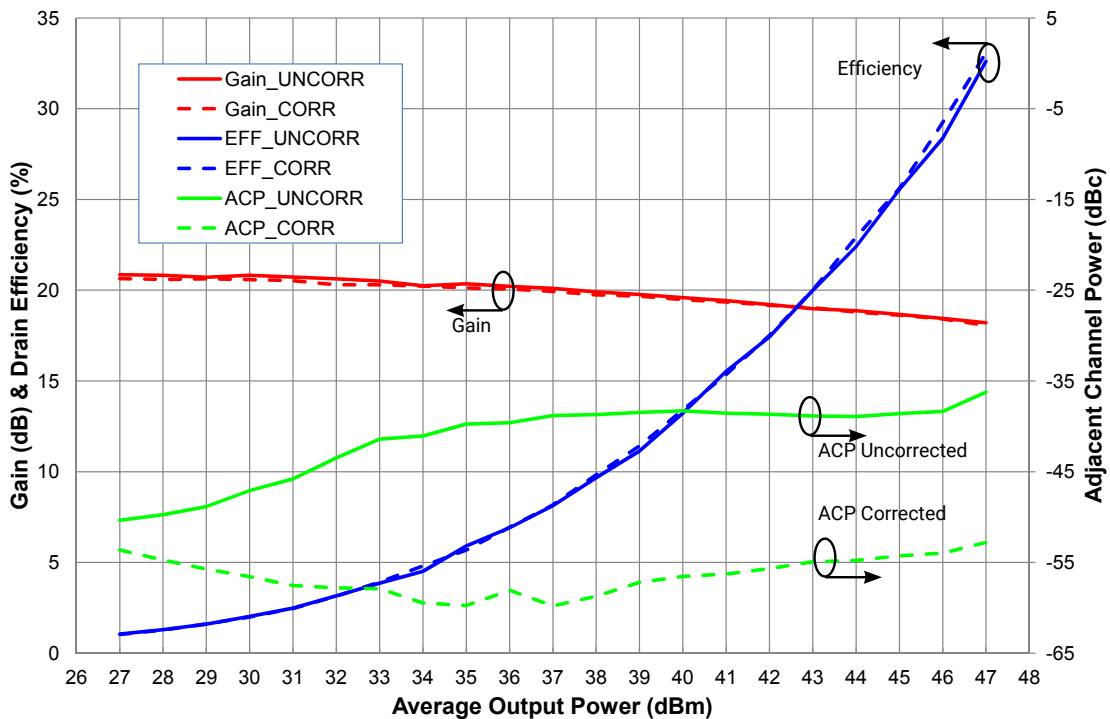


Figure 6. - CGHV22200 Typical Linearity under DPD vs. Output Power
 $V_{DD} = 50$, $I_{DQ} = 1.0$ A, Freq=2.14 GHz, 1 C WCDMA 7.5 PAR



Typical Performance

Figure 7. - Intermodulation Distortion Products vs Output Power
 Freq. = 2.1 GHz, VDD = 50 V, IDQ = 1.0 A, Tone Spacing = 100 kHz.

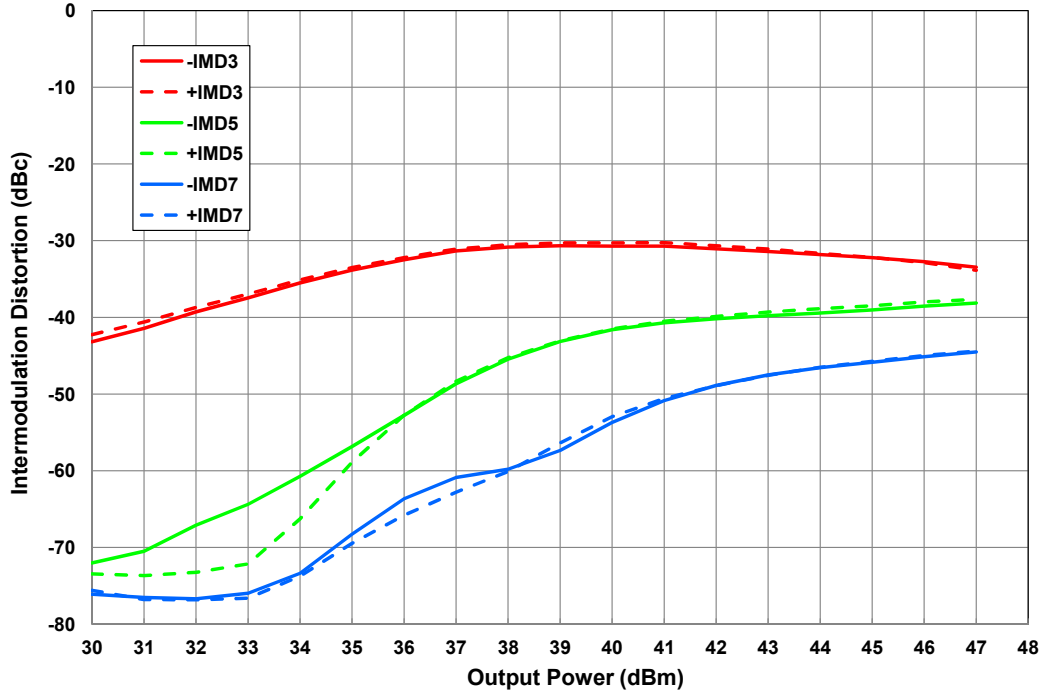
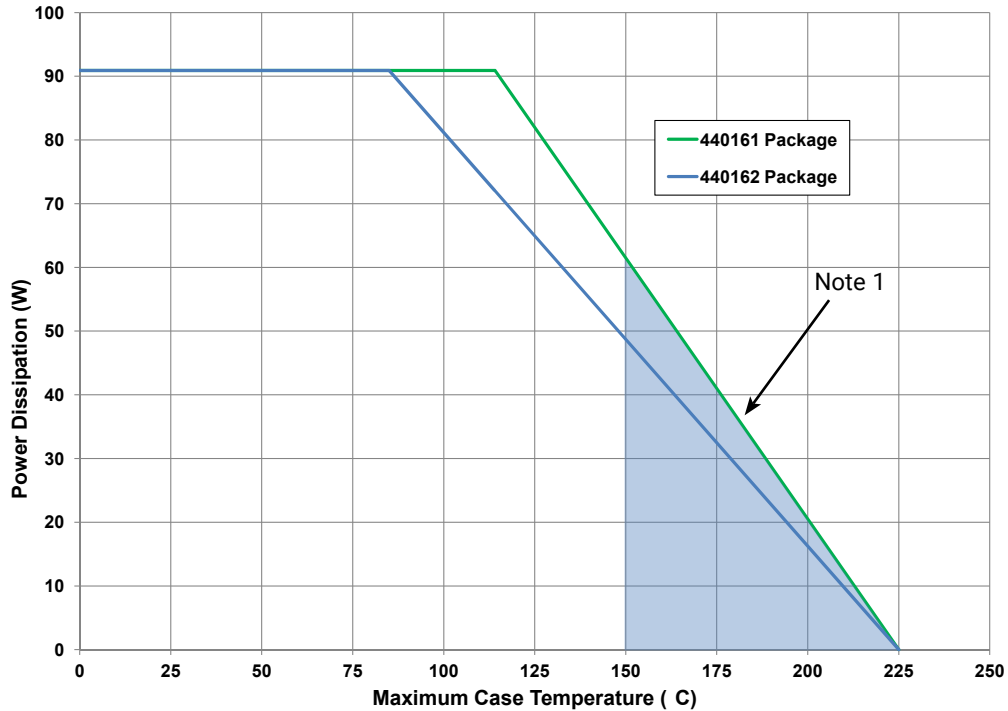
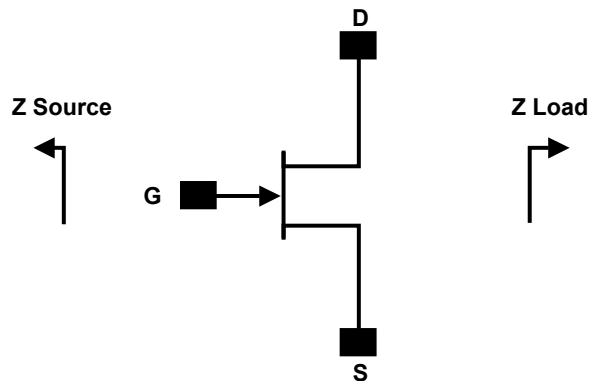


Figure 8. - Power Dissipation Derating Curve



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

Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
1800	10.6 - j7.3	2.7 + j0.6
1900	8.1 - j7.4	2.8 + j0.7
2000	6.1 - j6.6	2.9 + j0.8
2100	4.7 - j5.5	2.8 + j0.8
2200	3.7 - j4.3	2.6 + j0.8

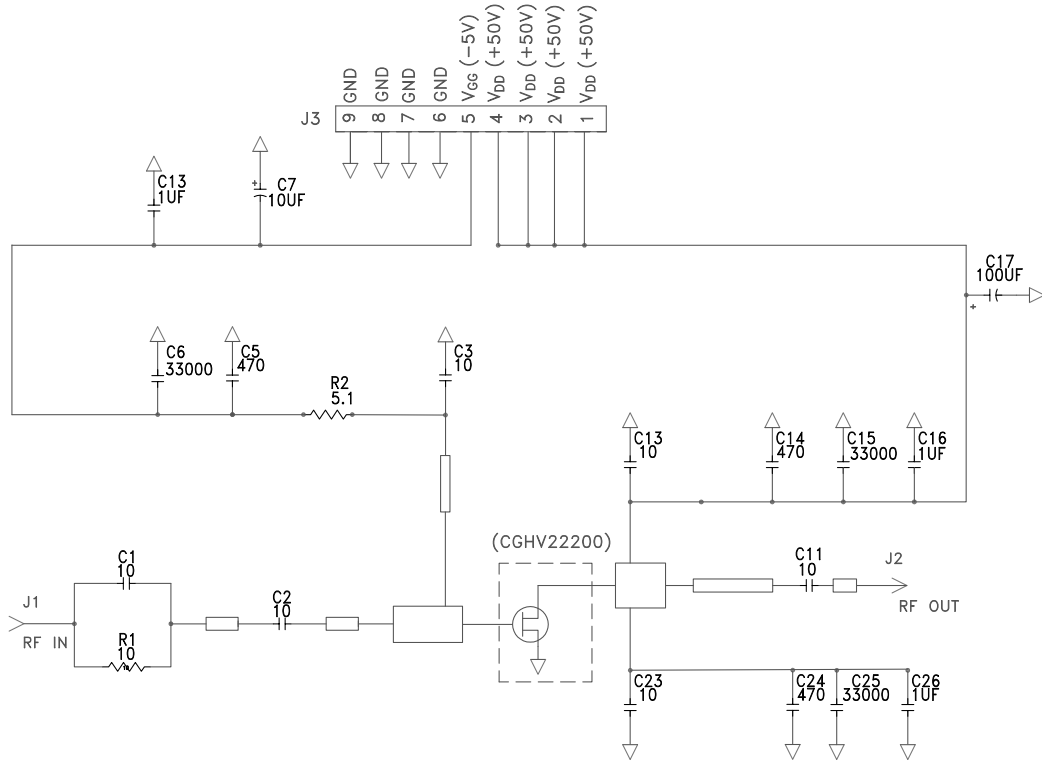
Note¹: $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$. In the 440162 package.

Note²: Impedances are extracted from CGHV22200-AMP demonstration circuit and are not source and load pull data derived from transistor.

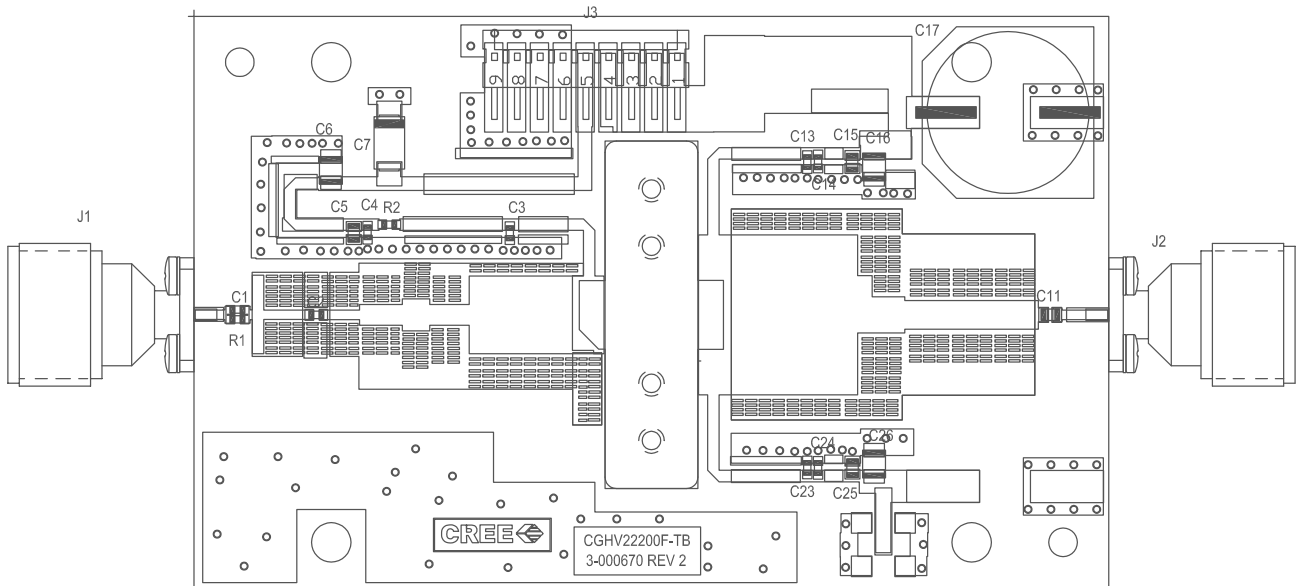
CGHV22200-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 1/16 W, 0603, 1%, 10.0 OHMS	1
R2	RES, 1/16 W, 0603, 1%, 5.1 OHMS	1
C4, C14, C24	CAP, 470 pF, 5%, 100 V, 0603, X	3
C6, C16, C26	CAP, 1.0 uF, 100 V, 10%, x7R, 121	3
C17, C27	CAP, 100 uF, 20%, 160 V, ELEC	2
C7	CAP, 10 uF, 16 V, TANTALUM, 2312	1
C1, C2, C3, C13, C23	CAP, 10.0 pF, 5%, 0603, ATC	5
C5, C15, C25	CAP, 33000 pF, 0805, 100 V, X7R	3
C11	CAP, 10 pF, 5%, 250 V, 0805, A	1
J1, J2	CONN, N, FEM, W/.500 SMA FLNG	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
	PCB, CGHV22200F, R04350, 0.020" THK	1
	2-56 SOC HD SCREW 1/4 SS	4
	#2 SPLIT LOCKWASHER SS	4
	CGHV22200	1

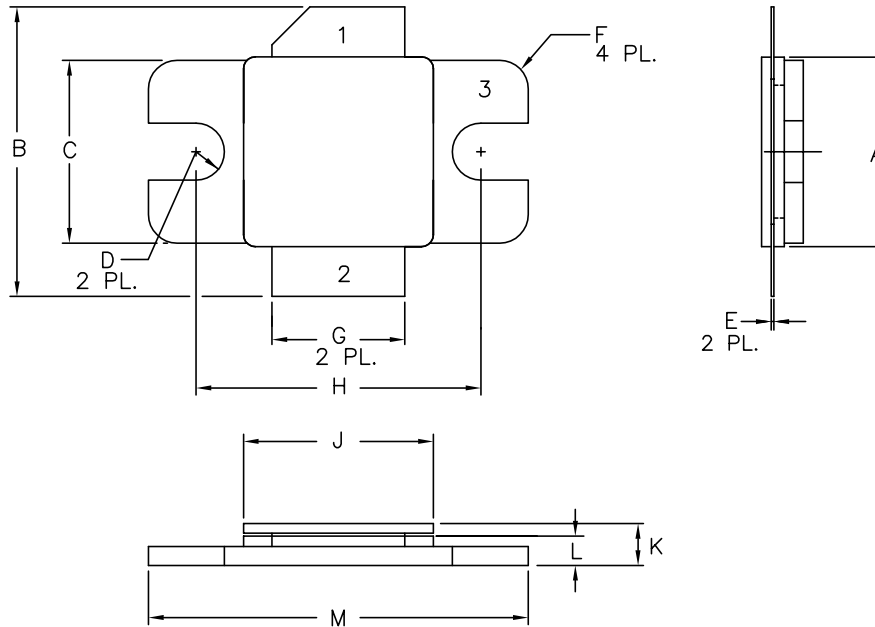
CGHV22200-AMP Demonstration Amplifier Circuit Schematic



CGHV22200-AMP Demonstration Amplifier Circuit Outline



Product Dimensions CGHV22200F (Package Type – 440162)



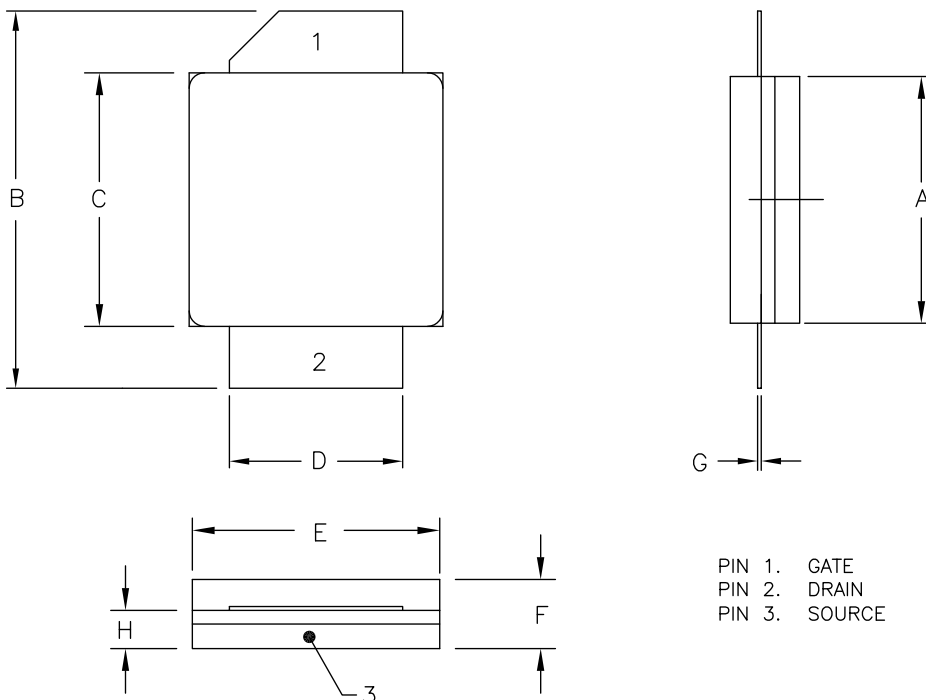
NOTES:

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 THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.395	.405	10.03	10.29
B	.580	.620	14.73	15.75
C	.380	.390	9.65	9.91
D	.055	.065	1.40	1.65
E	.004	.006	0.10	0.15
F	.055	.065	1.40	1.65
G	.275	.285	6.99	7.24
H	.595	.605	15.11	15.37
J	.395	.405	10.03	10.29
K	.129	.149	3.28	3.78
L	.053	.067	1.35	1.70
M	.795	.805	20.19	20.45

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

Product Dimensions CGHV22200P (Package Type – 440161)



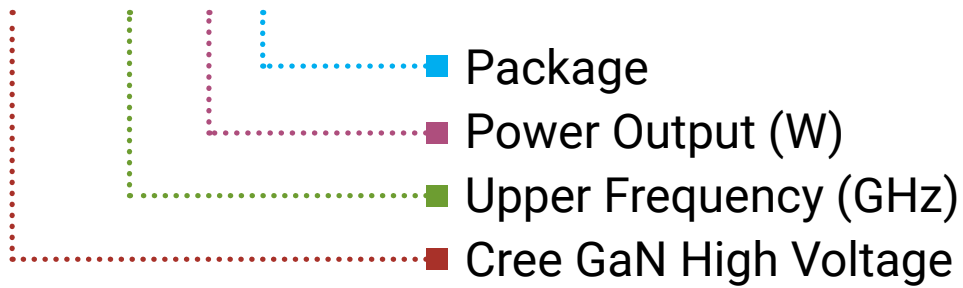
NOTES:

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	.395	.407	10.03	10.34
B	.594	.634	15.09	16.10
C	.395	.407	10.03	10.34
D	.275	.285	6.99	7.24
E	.395	.407	10.03	10.34
F	.129	.149	3.28	3.78
G	.004	.006	0.10	0.15
H	.057	.067	1.45	1.70

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

CGHV22200F



Parameter	Value	Units
Upper Frequency ¹	2.2	GHz
Power Output	200	W
Package	Flange	-

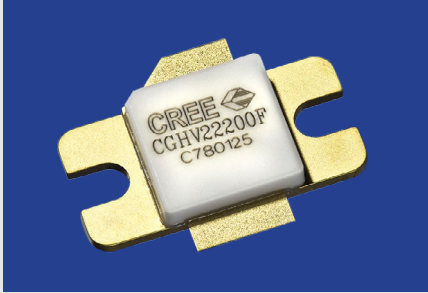
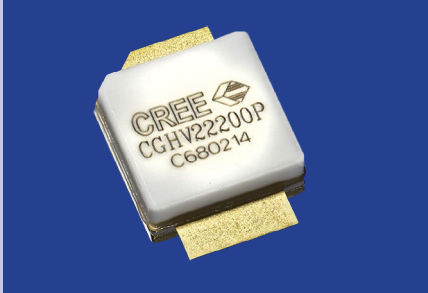
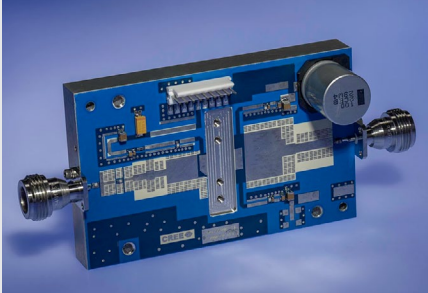
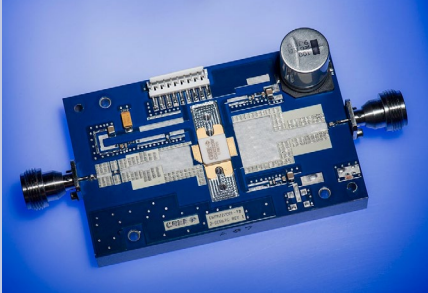
Table 1.

Note¹: 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.

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV22200F	GaN HEMT	Each	
CGHV22200P	GaN HEMT	Each	
CGHV22200-TB	Test board without GaN HEMT	Each	
CGHV22200F-AMP	Test board with GaN HEMT installed	Each	



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