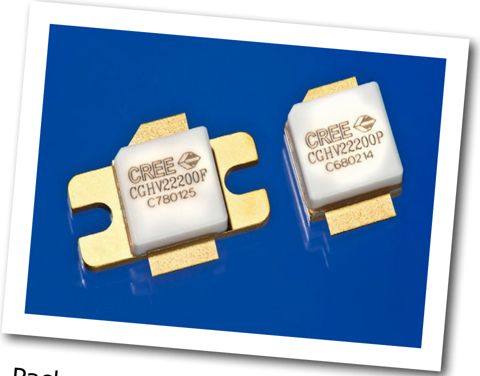
CGHV22200

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°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-TB 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 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

Rev 0.1 – August 2013

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

Parameter	Symbol	Rating	Units	Units
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˚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 = 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}	125	–	–	V_{DC}	V_{GS} = -8 V, I_D = 32 mA
RF Characteristics[3] (T_C = 25˚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 μS, Duty Cycle = 10%
[4] P_{SAT} is defined as I_G = 3 mA peak.
[5] Measured in CGHV22200-TB.
[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.

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Typical Performance

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

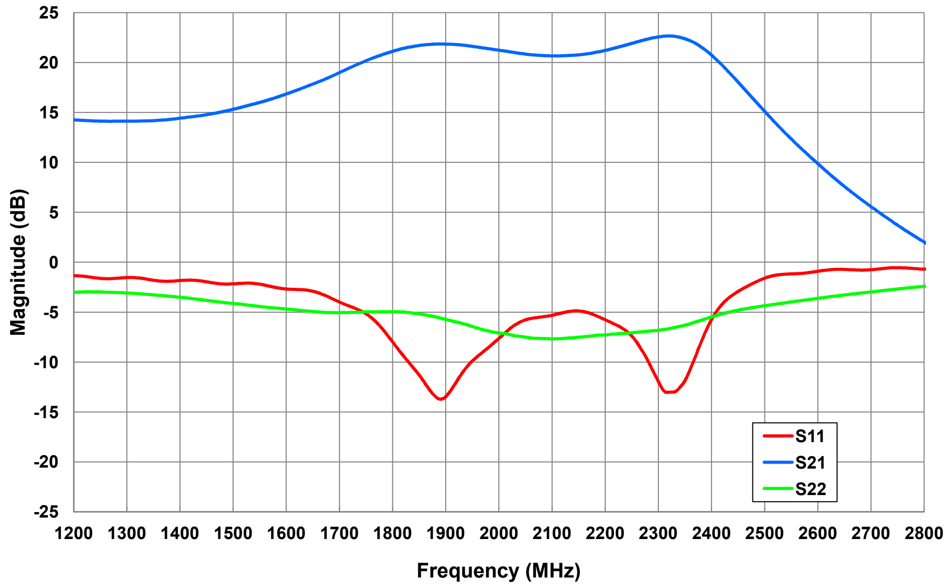
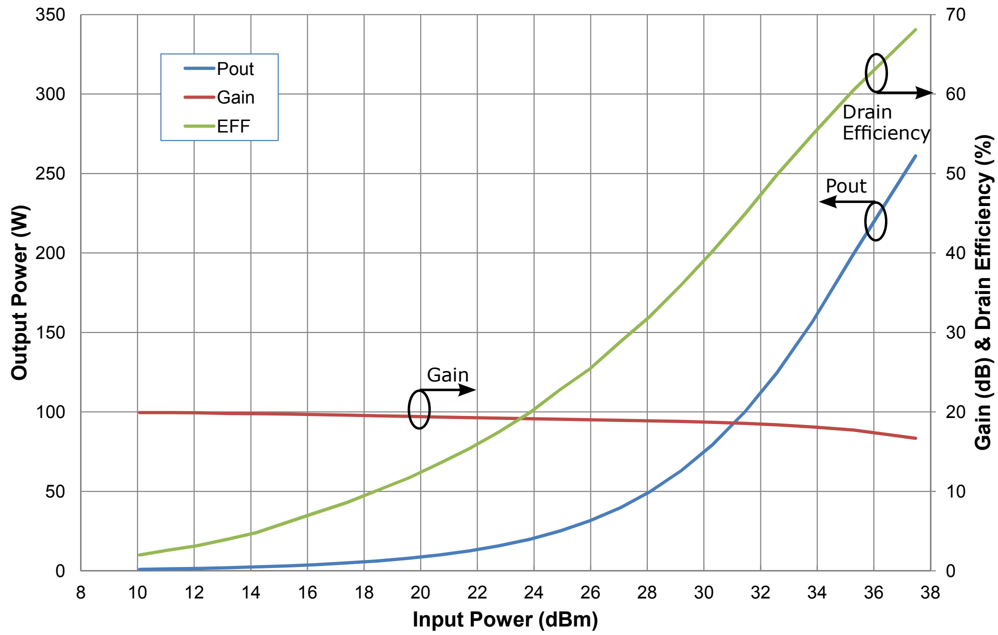


Figure 2. - Typical Gain and Drain Efficiency vs Input Power of the CGHV22200 measured in CGHV22200-TB Amplifier Circuit.
V_{DS} = 50 V, I_{DQ} = 1.0 A, Freq = 2.1 GHz, Pulse Width = 100 μs, Duty Cycle = 10 %



Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Typical Performance

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

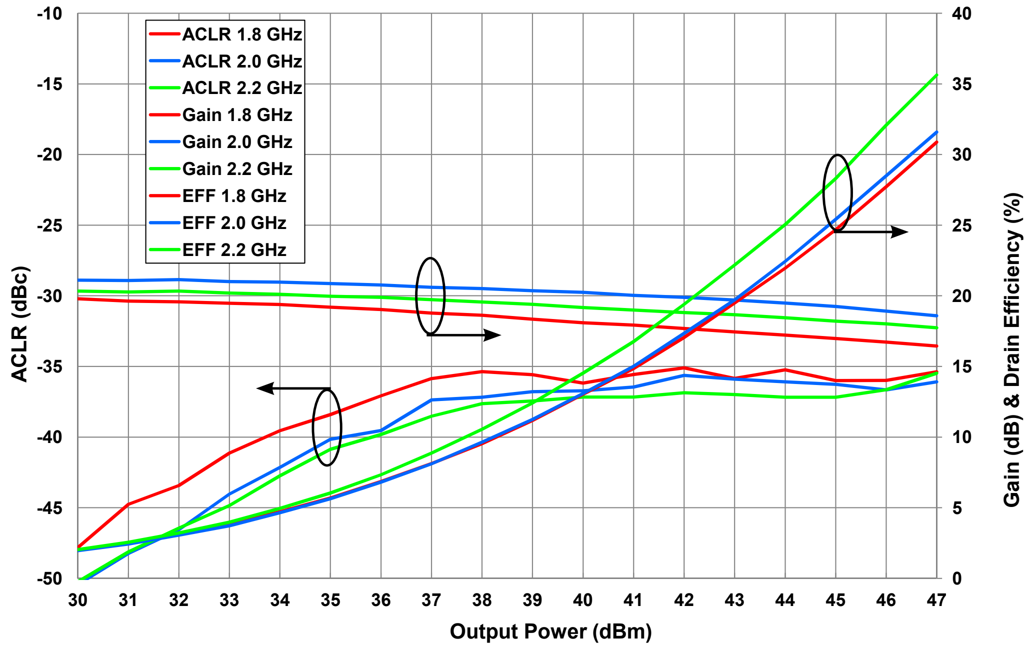
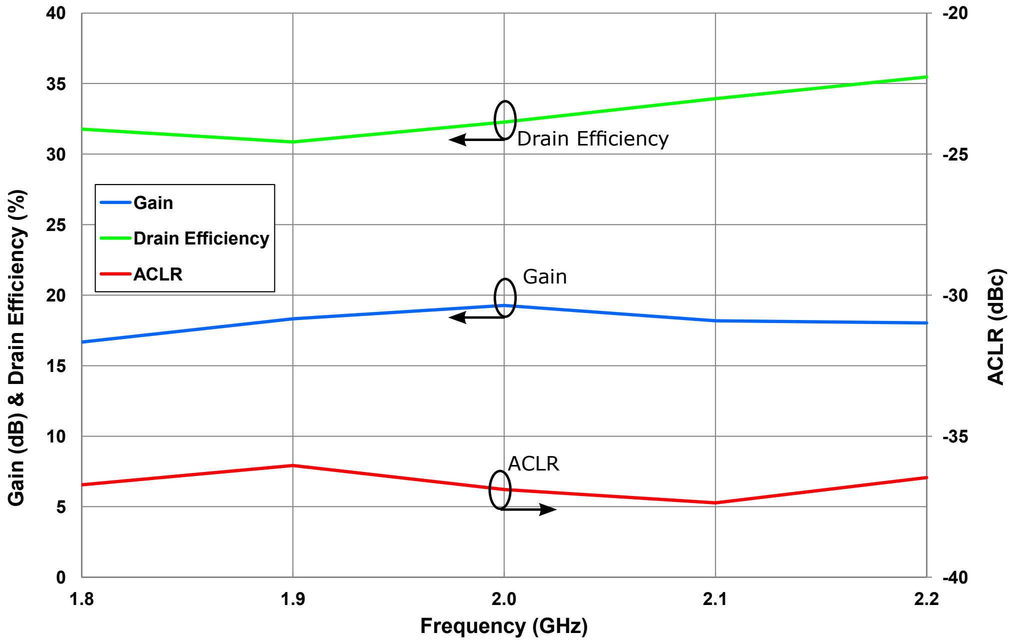


Figure 4. - Typical Gain, Drain Efficiency and ACLR vs Frequency of the CGHV22200 measured in CGHV22200-TB Amplifier Circuit
V_{DD} = 50 V, I_{DS} = 1.0 A, P_{AVE} = 50 W, 1c WCDMA, PAR = 7.5 dB



Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

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

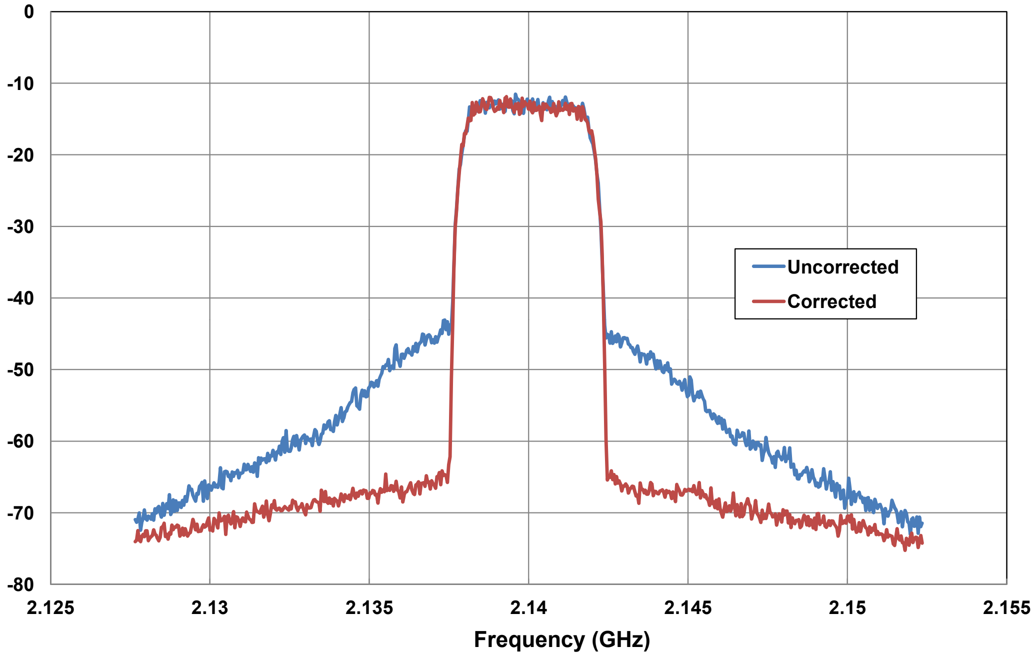
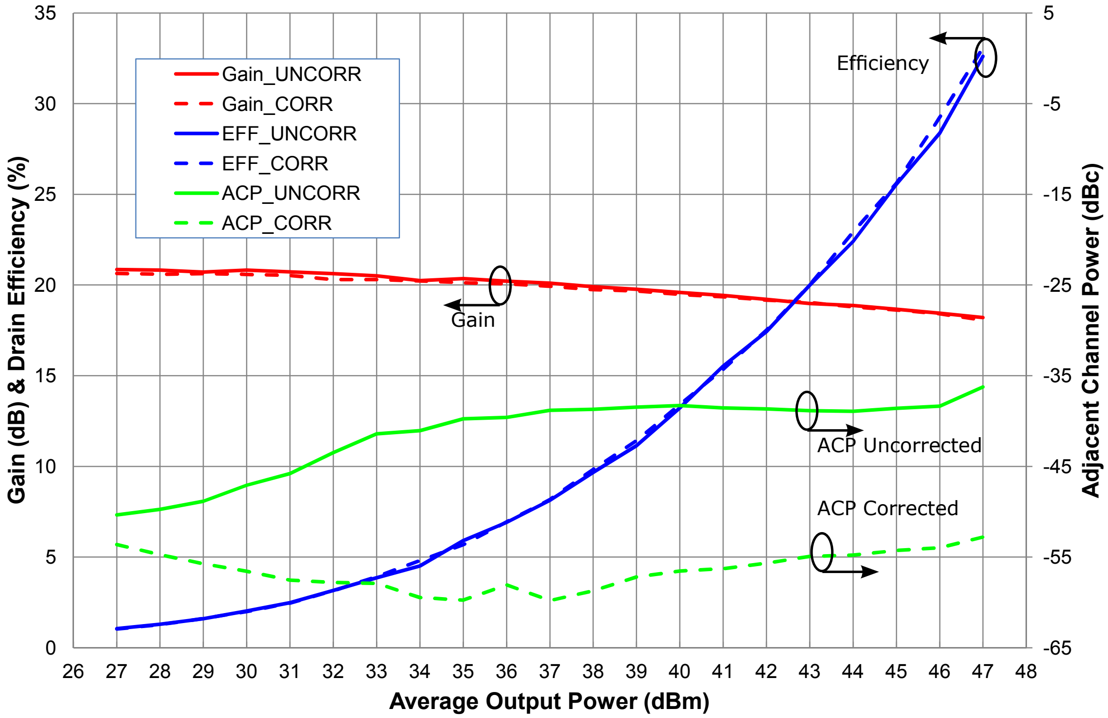


Figure 6. - CGHV22200 Typical Linearity under DPD vs. Output Power
V_{DD}=50, I_{DQ}=1.0 A, Freq=2.14 GHz, 1 C WCDMA 7.5 PAR



Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

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.

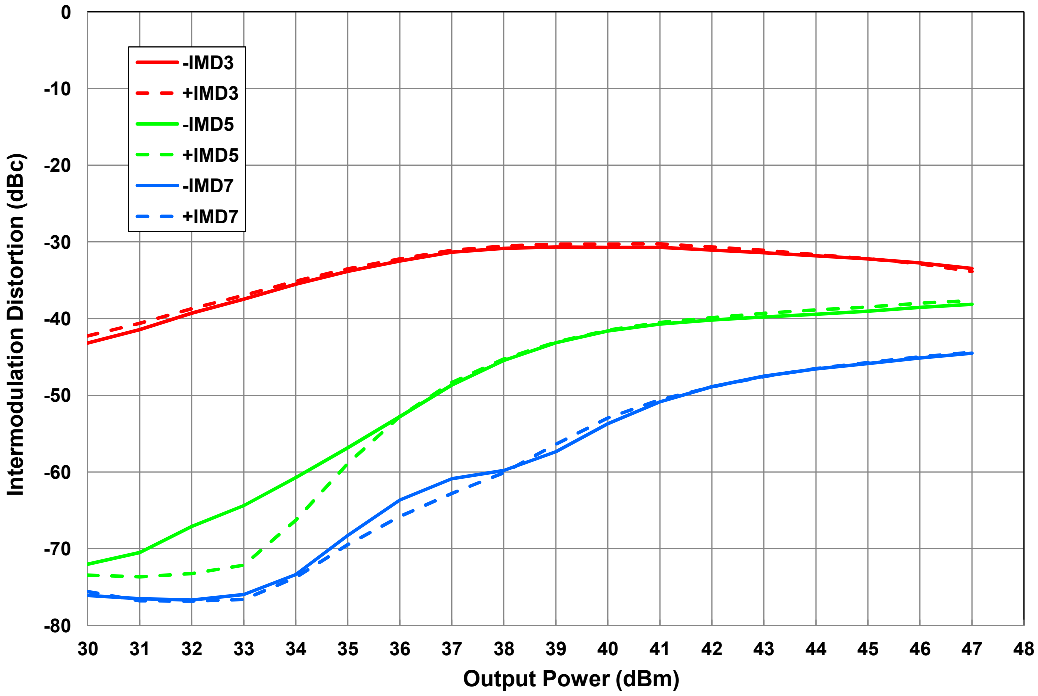
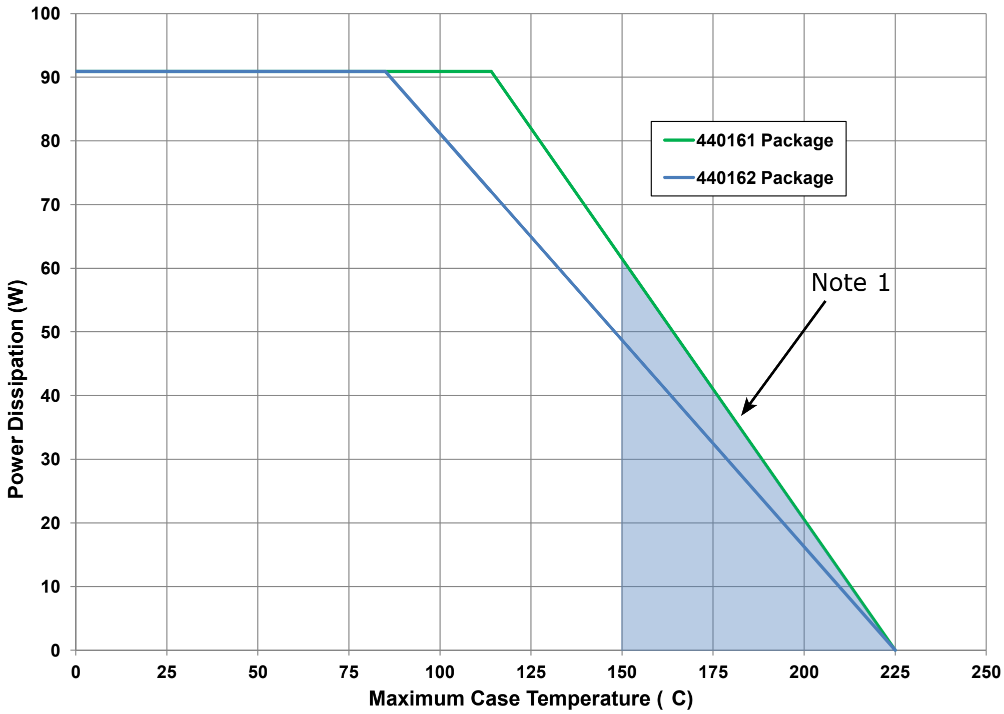


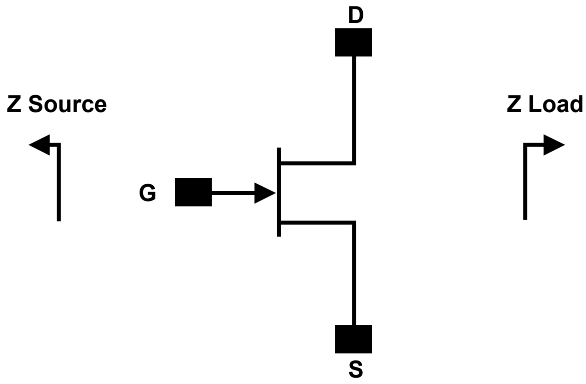
Figure 8. - Power Dissipation Derating Curve



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

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

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

Note[1]: V_{DD} = 50 V, I_{DQ} = 1.0 A. In the 440162 package.
Note[2]: Impedances are extracted from CGHV22200-TB demonstration circuit and are not source and load pull data derived from transistor.

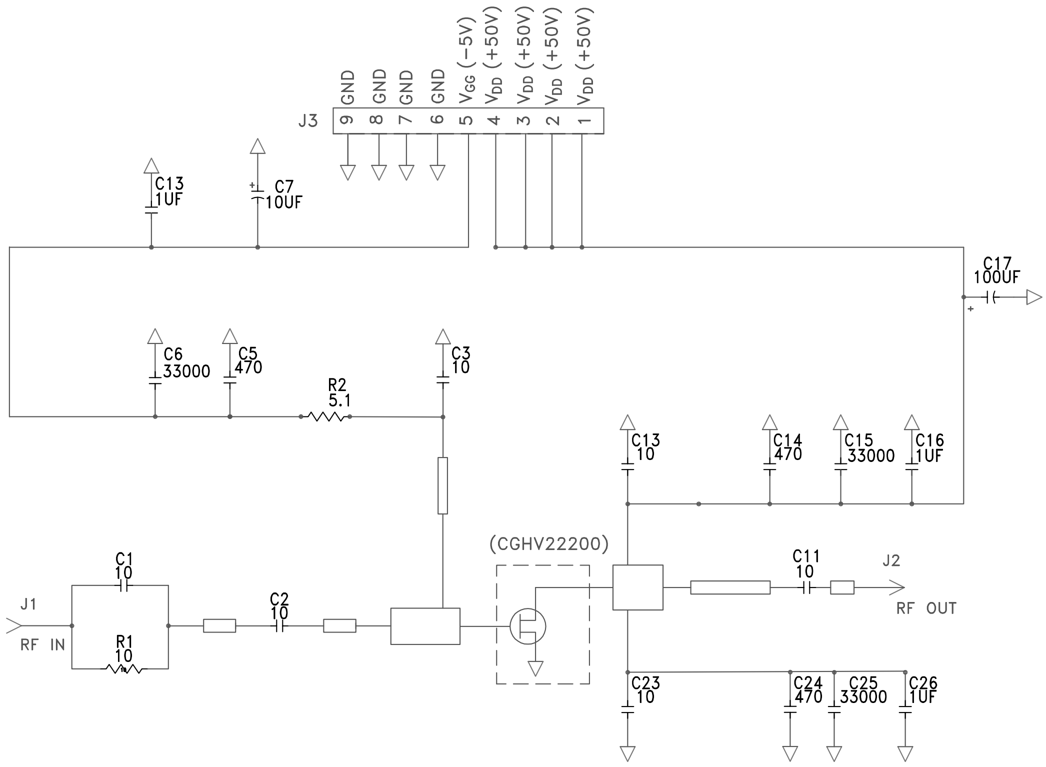
Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

CGHV22200-TB Demonstration Amplifier Circuit Bill of Materials

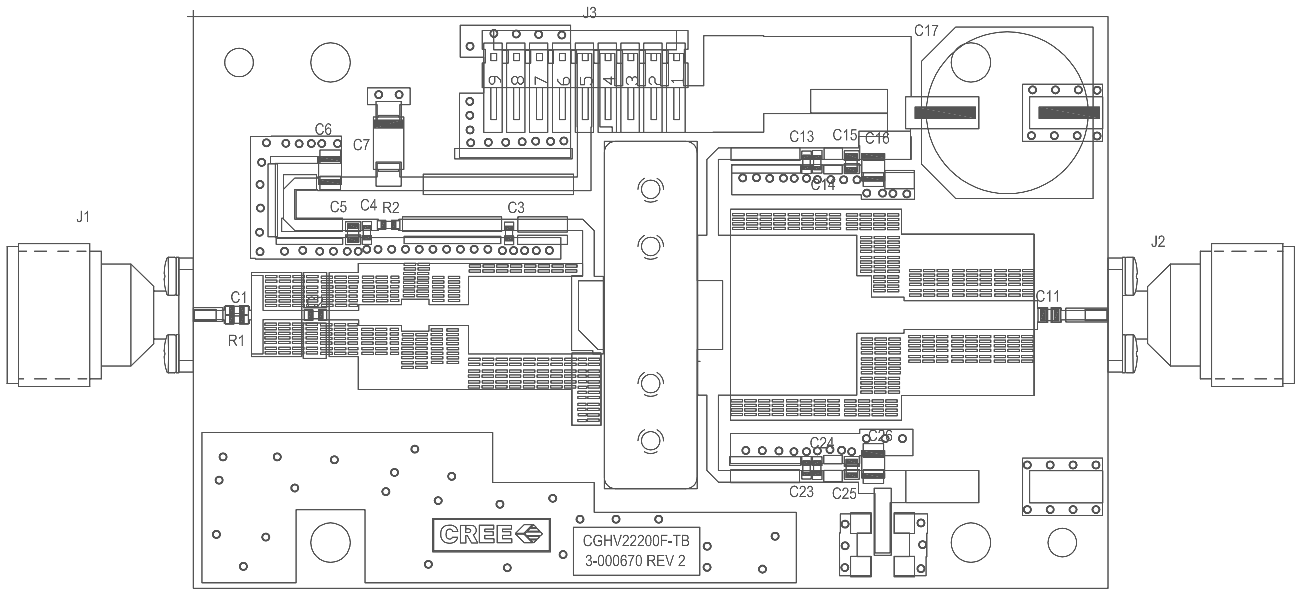
Designator	Description	Qty
R1	RES, 1/16 W, 0603, 1%, 10.0 OHMS	1
R2	RES, 1/16 W, 0603, 1%, 5.1 OHMS	1
C4, C14, C24	CAP, 470 pF, 5%, 100 V, 0603, X	3
C6,C16, C26	CAP, 1.0 UF, 100 V, 10%, x7R, 121	3
C17, C27	CAP, 100 UF, 20%, 160 V, ELEC	2
C7	CAP, 10 UF, 16 V, TANTALUM, 2312	1
C1, C2, C3, C13, C23	CAP, 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, RO4350,0.020” THK	1
	2-56 SOC HD SCREW 1/4 SS	4
	#2 SPLIT LOCKWASHER SS	4
	CGHV22200	1

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

CGHV22200-TB Demonstration Amplifier Circuit Schematic

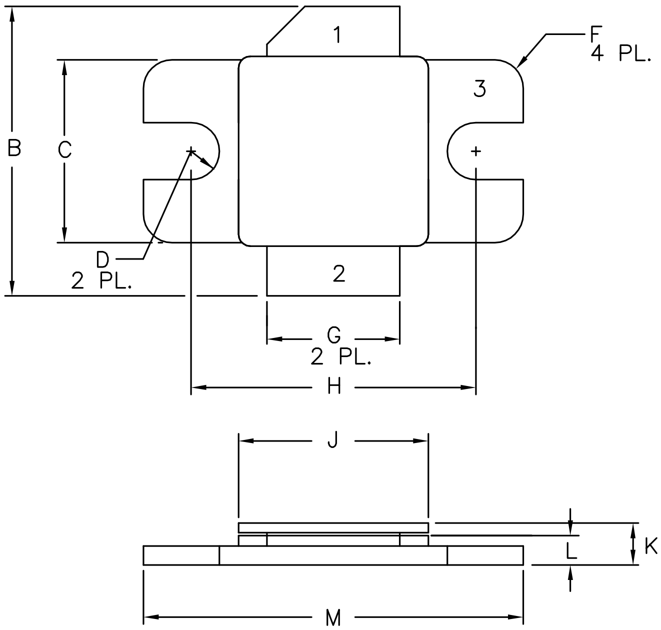


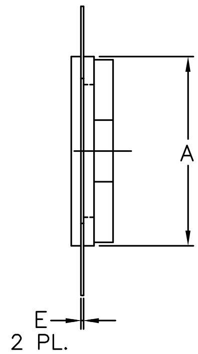
CGHV22200-TB Demonstration Amplifier Circuit Outline



Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Product Dimensions CGHV22200F (Package Type — 440162)





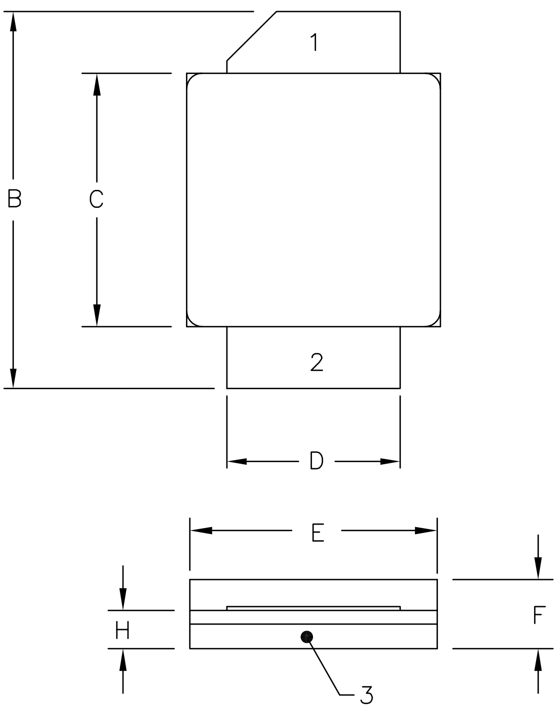
NOTES:

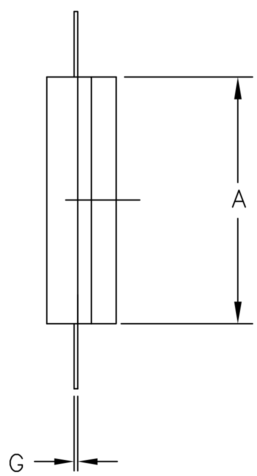
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
4. LID MAY BE MISALIGNED TO THE BODY OF THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

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)





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

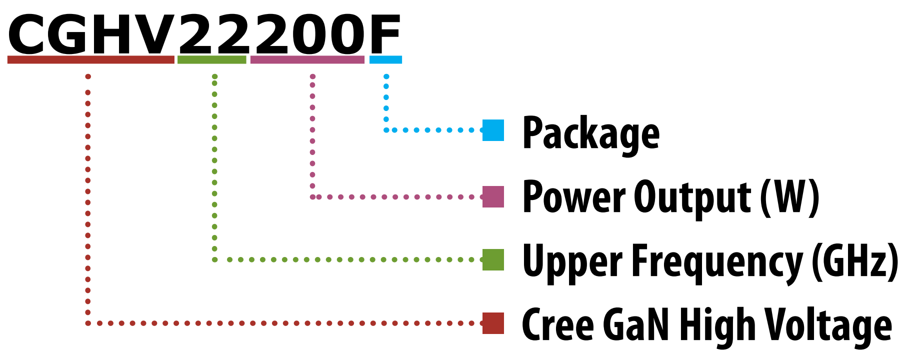
NOTES:

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

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Part Number System



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

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.

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Disclaimer

Specifications are subject to change without notice. Cree, Inc. believes the information contained within this data sheet to be accurate and reliable. However, no responsibility is assumed by Cree for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Cree. Cree makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose. "Typical" parameters are the average values expected by Cree in large quantities and are provided for information purposes only. These values can and do vary in different applications and actual performance can vary over time. All operating parameters should be validated by customer's technical experts for each application. Cree products are not designed, intended or authorized for use as components in applications intended for surgical implant into the body or to support or sustain life, in applications in which the failure of the Cree product could result in personal injury or death or in applications for planning, construction, maintenance or direct operation of a nuclear facility.

For more information, please contact:

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
www.cree.com/rf

Sarah Miller
Marketing & Export
Cree, RF Components
1.919.407.5302

Ryan Baker
Marketing
Cree, RF Components
1.919.407.7816

Tom Dekker
Sales Director
Cree, RF Components
1.919.407.5639

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf