

# CGHV22100

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

Cree's CGHV22100 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 CGHV22100 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: CGHV22100F and CGHV22100P

## 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 @ 44 dBm	18.7	20.7	22.0	dB
ACLR @ 44 dBm	-37.8	-37.1	-35.1	dBc
Drain Efficiency @ 44 dBm	35.4	31.7	30.6	%

**Note:**

Measured in the CGHV22100-AMP amplifier circuit, under WCDMA 3GPP test model 1, 64 DPCH, 45% clipping, PAR = 7.5 dB @ 0.01% Probability on CCDF.

## Features



- 1.8 - 2.2 GHz Operation
- 20 dB Gain
- -35 dBc ACLR at 25 W  $P_{AVE}$
- 31-35 % Efficiency at 25 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 <sup>3</sup>	$T_J$	225	°C	
Maximum Forward Gate Current	$I_{GMAX}$	16	mA	25°C
Maximum Drain Current <sup>1</sup>	$I_{DMAX}$	6	A	25°C
Soldering Temperature <sup>2</sup>	$T_S$	245	°C	
Screw Torque	$\tau$	80	in-oz	
Thermal Resistance, Junction to Case <sup>3</sup>	$R_{\theta JC}$	2.34	°C/W	85°C, $P_{DISS} = 48$ W
Thermal Resistance, Junction to Case <sup>4</sup>	$R_{\theta JC}$	2.95	°C/W	85°C, $P_{DISS} = 48$ W
Case Operating Temperature <sup>5</sup>	$T_C$	-40, +150	°C	

**Note:**

- <sup>1</sup> Current limit for long term, reliable operation.
- <sup>2</sup> Refer to the Application Note on soldering at <http://www.cree.com/rf/document-library>
- <sup>3</sup> Measured for the CGHV22100P
- <sup>4</sup> Measured for the CGHV22100F
- <sup>5</sup> See also, the Power Dissipation De-rating Curve on Page 4.

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

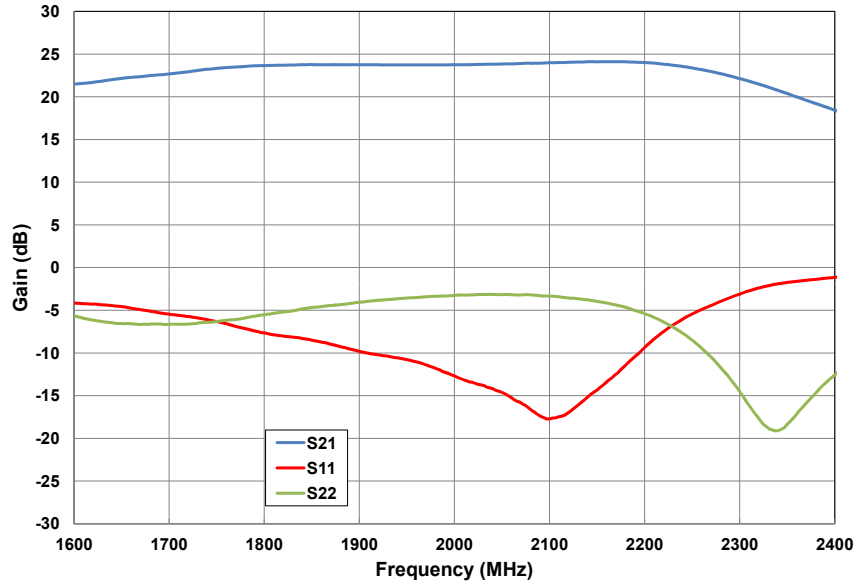
Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics<sup>1</sup></b>						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	$V_{DC}$	$V_{DS} = 10$ V, $I_D = 16$ mA
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	$V_{DC}$	$V_{DS} = 50$ V, $I_D = 0.5$ A
Saturated Drain Current <sup>2</sup>	$I_{DS}$	12	14.4	-	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	$V_{BR}$	150	-	-	$V_{DC}$	$V_{GS} = -8$ V, $I_D = 16$ mA
<b>RF Characteristics<sup>3</sup> (<math>T_c = 25^\circ\text{C}</math>, <math>F_0 = 2.17</math> GHz unless otherwise noted)</b>						
Gain <sup>4</sup>	G	19.75	22	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 0.5$ A, $P_{OUT} = 44$ dBm
WCDMA Linearity <sup>4</sup>	ACLR	-	-35	-31	dBc	$V_{DD} = 50$ V, $I_{DQ} = 0.5$ A, $P_{OUT} = 44$ dBm
Drain Efficiency <sup>4</sup>	$\eta$	26.5	30.5	-	%	$V_{DD} = 50$ V, $I_{DQ} = 0.5$ A, $P_{OUT} = 44$ dBm
Output Mismatch Stress	VSWR	-	-	10 : 1	$\Psi$	No damage at all phase angles, $V_{DD} = 50$ V, $I_{DQ} = 0.5$ A, $P_{OUT} = 100$ W Pulsed
<b>Dynamic Characteristics</b>						
Input Capacitance <sup>5</sup>	$C_{GS}$	-	66	-	pF	$V_{DS} = 50$ V, $V_{GS} = -8$ V, $f = 1$ MHz
Output Capacitance <sup>5</sup>	$C_{DS}$	-	8.7	-	pF	$V_{DS} = 50$ V, $V_{GS} = -8$ V, $f = 1$ MHz
Feedback Capacitance	$C_{GD}$	-	0.47	-	pF	$V_{DS} = 50$ V, $V_{GS} = -8$ V, $f = 1$ MHz

**Notes:**

- <sup>1</sup> Measured on wafer prior to packaging.
- <sup>2</sup> Scaled from PCM data.
- <sup>3</sup> Measured in CGHV22100-AMP
- <sup>4</sup> Single Carrier WCDMA, 3GPP Test Model 1, 64 DPCH, 45% Clipping, PAR = 7.5 dB @ 0.01% Probability on CCDF.
- <sup>5</sup> Includes package and internal matching components.

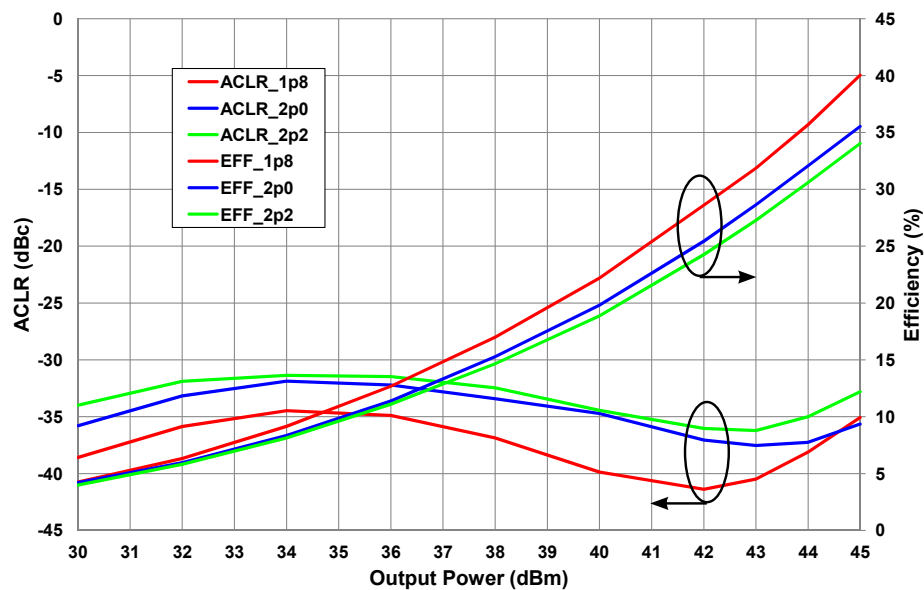
## Typical Performance

**Figure 1. - Small Signal Gain and Return Losses vs Frequency for the CGHV22100 measured in CGHV22100-AMP Amplifier Circuit**  
 $V_{DD} = 50\text{ V}, I_{DQ} = 0.5\text{ A}$



## Typical Linear Performance

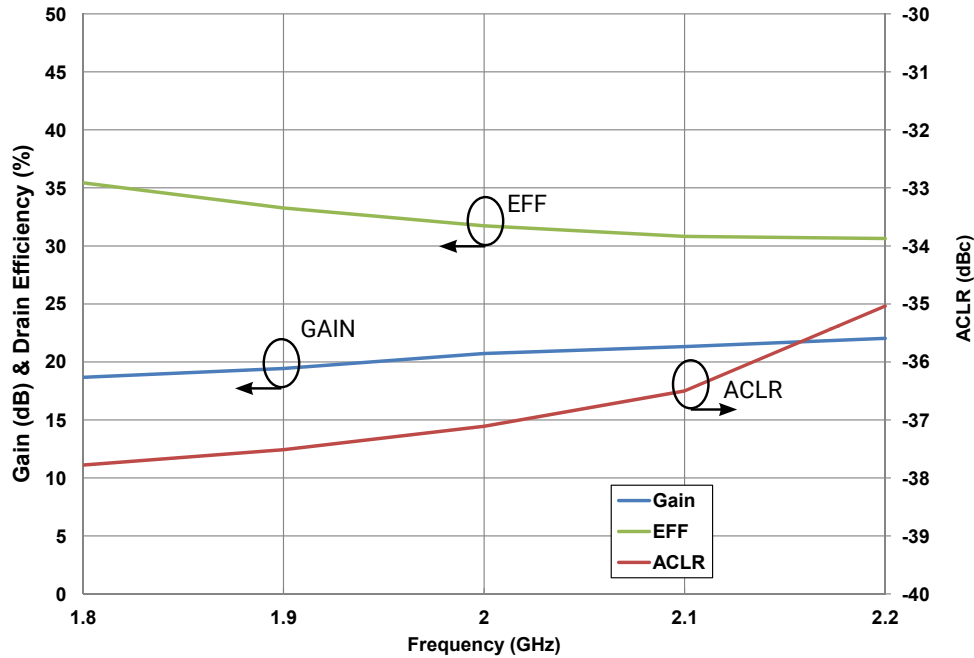
**Figure 2. - Typical Drain Efficiency and ACLR vs Output Power of the CGHV22100 measured in CGHV22100-AMP Amplifier Circuit.**  
 $V_{DS} = 50\text{ V}, I_{DS} = 0.5\text{ A}, 1\text{c WCDMA}, \text{PAR} = 7.5\text{ dB}$



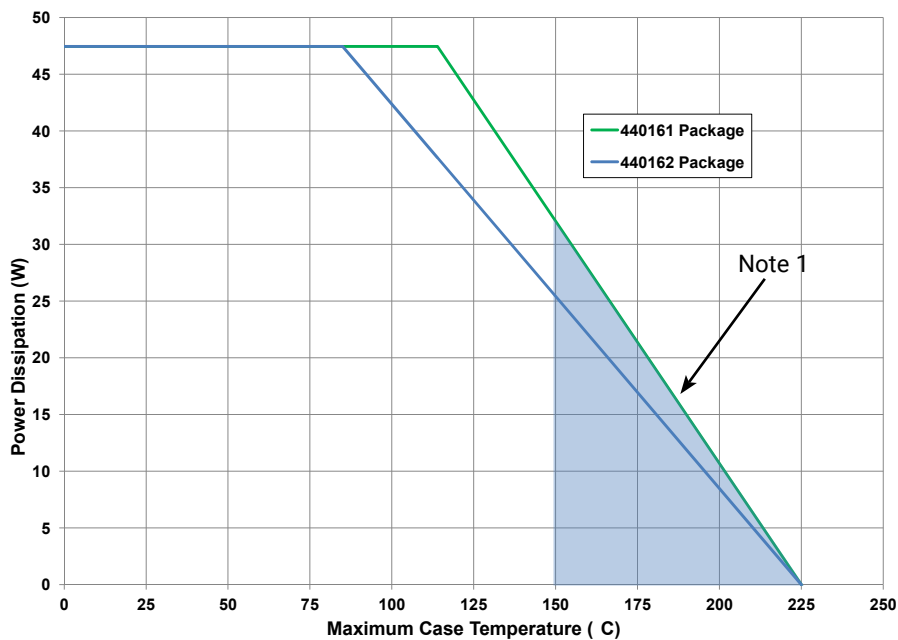
## Typical Performance

**Figure 3. - Typical Gain, Drain Efficiency and ACLR vs Frequency of CGHV22100 measured in CGHV22100-AMP Amplifier Circuit.**

$V_{DS} = 50\text{ V}$ ,  $I_{DS} = 0.5\text{ A}$ ,  $P_{AVE} = 25\text{ W}$ , 1c WCDMA, PAR = 7.5 dB

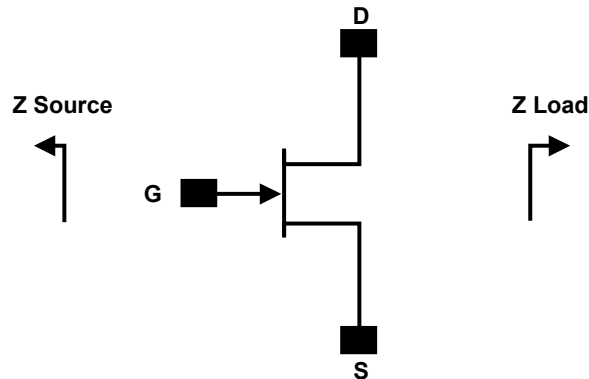


## CGHV22100 Power Dissipation De-rating Curve



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

## Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
1800	4.50 + j0.91	5.21 - j2.58
1900	5.20 + j1.15	5.01 - j2.09
2000	6.02 + j1.03	4.85 - j1.61
2100	6.75 + j0.42	4.70 - j1.12
2200	7.03 - j0.64	4.58 - j0.62

Note<sup>1</sup>:  $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 0.5\text{ A}$ . In the 440162 package.

Note<sup>2</sup>: Impedances are extracted from CGHV22100-AMP demonstration circuit and are not source and load pull data derived from transistor.

## 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

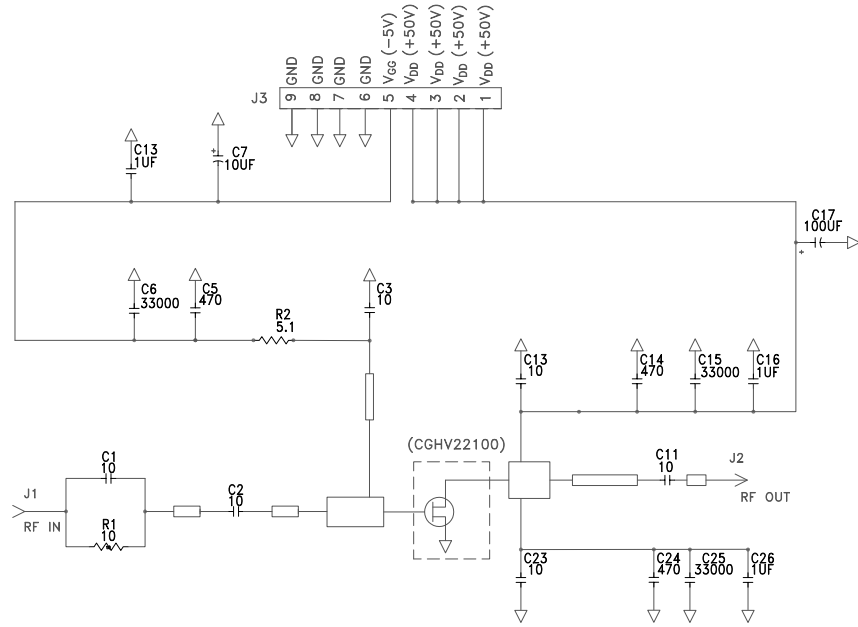
## CGHV22100-AMP1 Demonstration Amplifier Circuit Bill of Materials

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
	BASEPLATE, CGH35120	
	PCB, CGHV22100F, RO4350	1
	2-56 SOC HD SCREW 1/4 SS	4
	#2 SPLIT LOCKWASHER SS	4
	CGHV22100F	1

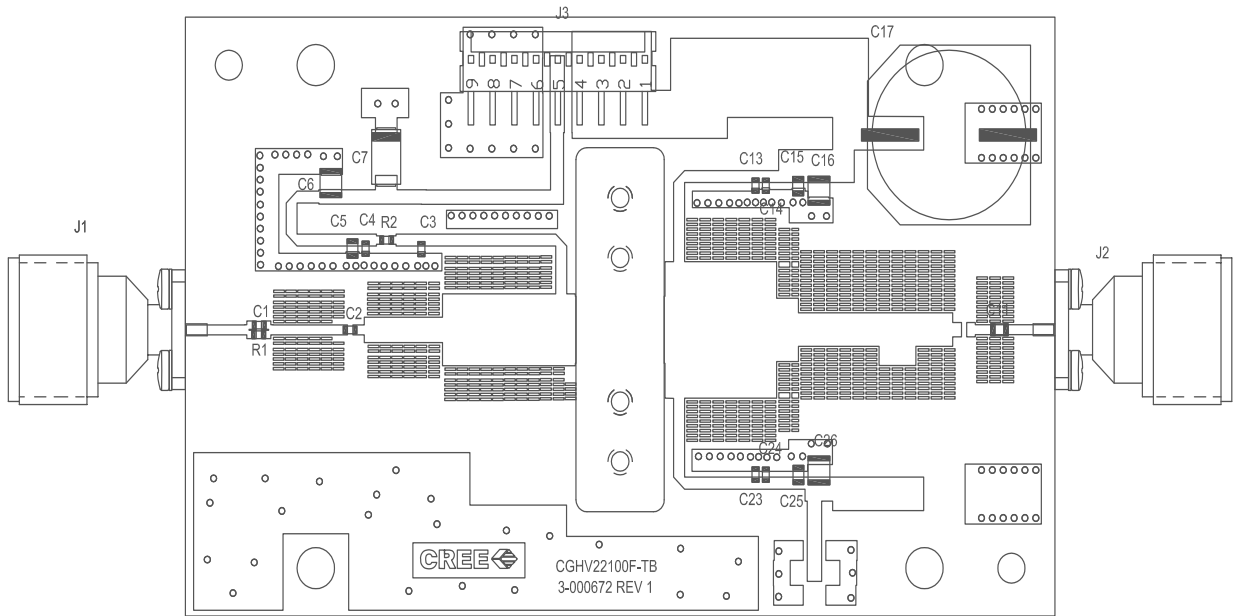
## CGHV22100-AMP Demonstration Amplifier Circuit



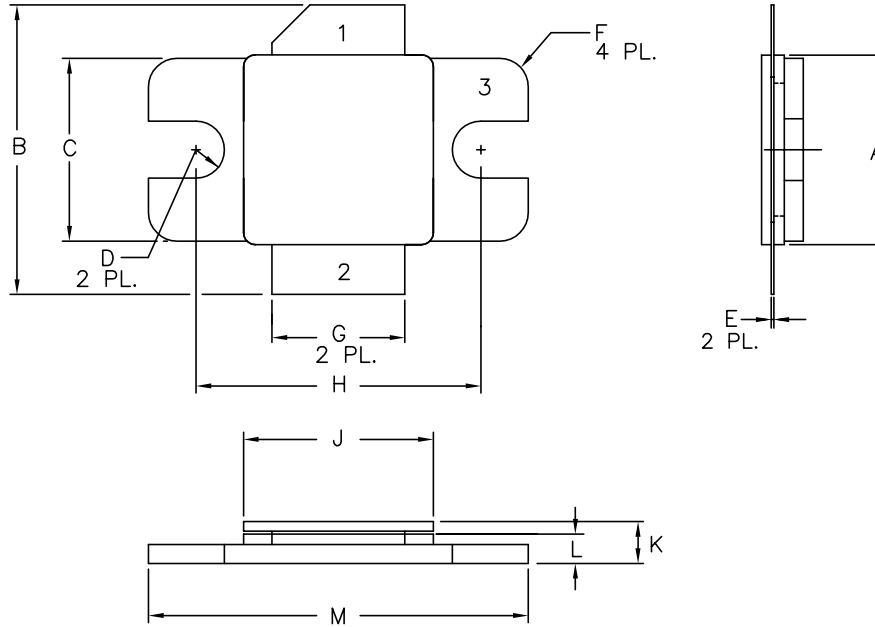
## CGHV22100-AMP Demonstration Amplifier Circuit Schematic



## CGHV22100-AMP Demonstration Amplifier Circuit Outline



## Product Dimensions CGHV22100 (Package Type – 440162)



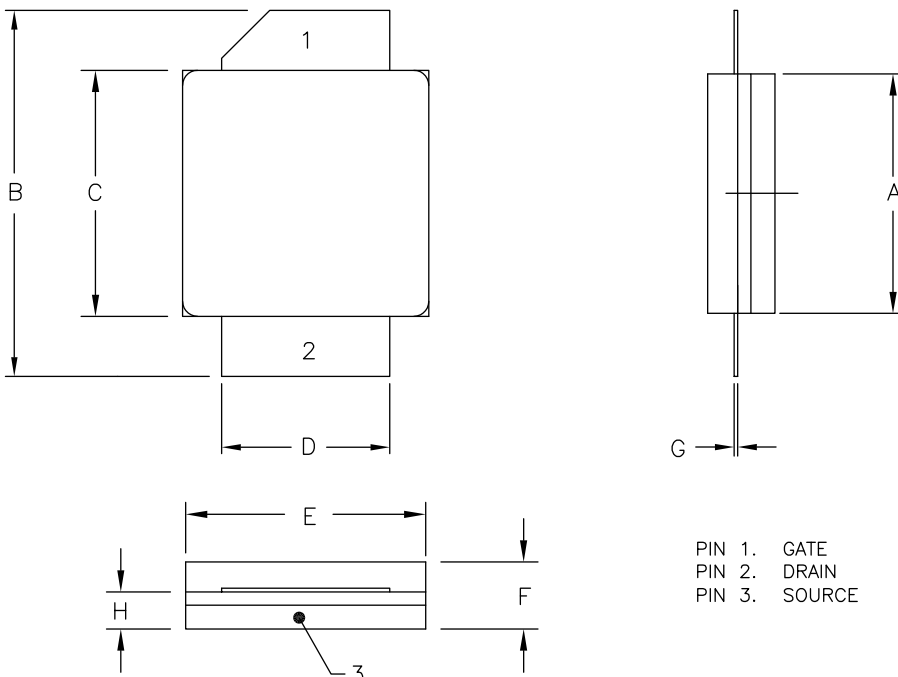
**NOTES:**

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 CGHV22100 (Package Type – 440161)



**NOTES:**

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

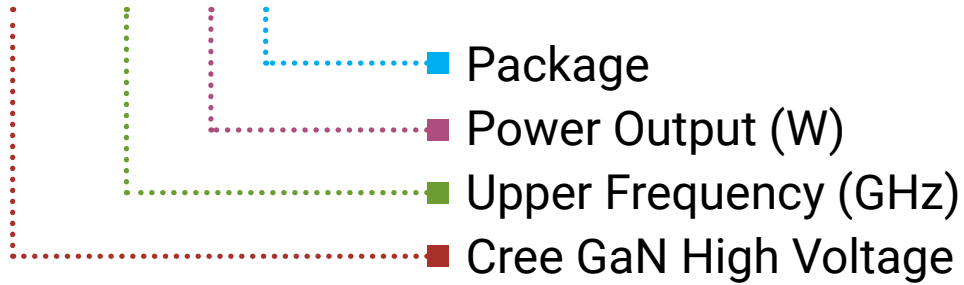
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.395	.407	10.03	10.34
B	.594	.634	15.09	16.10
C	.395	.407	10.03	10.34
D	.275	.285	6.99	7.24
E	.395	.407	10.03	10.34
F	.129	.149	3.28	3.78
G	.004	.006	0.10	0.15
H	.057	.067	1.45	1.70

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



## Part Number System

### CGHV22100F



Parameter	Value	Units
Upper Frequency <sup>1</sup>	2.2	GHz
Power Output	100	W
Package	Flange	-

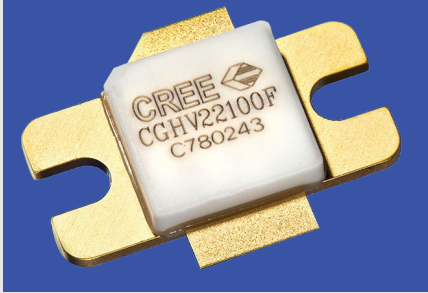

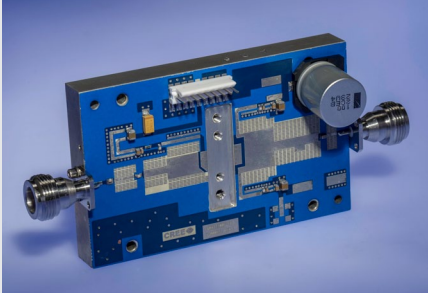
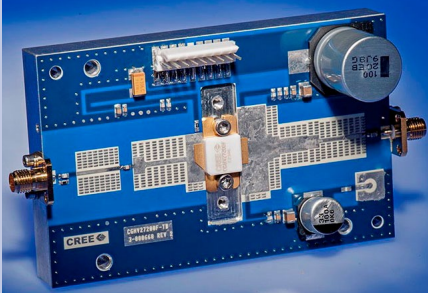
**Table 1.**

**Note<sup>1</sup>:** 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
CGHV22100F	GaN HEMT	Each	
CGHV22100P	GaN HEMT	Each	
CGHV22100-TB	Test board without GaN HEMT	Each	
CGHV22100F-AMP	Test board with GaN HEMT installed	Each	



## Disclaimer

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