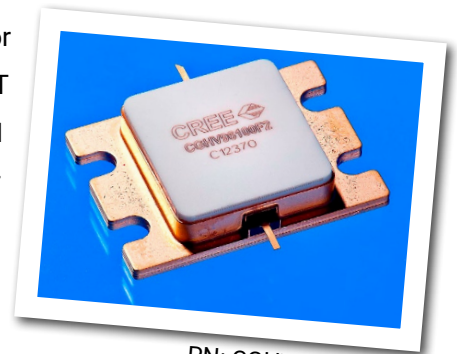


# CGHV96100F2

100 W, 7.9 - 9.6 GHz, 50-ohm, Input/Output Matched GaN HEMT

Cree's CGHV96100F2 is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT) on Silicon Carbide (SiC) substrates. This GaN Internally Matched (IM) FET offers excellent power added efficiency in comparison to other technologies. GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity and higher thermal conductivity. GaN HEMTs also offer greater power density and wider bandwidths compared to GaAs transistors. This IM FET is available in a metal/ceramic flanged package for optimal electrical and thermal performance.



PN: CGHV96100F2  
Package Type: 440210

## Typical Performance Over 8.4-9.6 GHz ( $T_c = 25^\circ\text{C}$ )

Parameter	8.4 GHz	8.8 GHz	9.0 GHz	9.2 GHz	9.4 GHz	9.6 GHz	Units
Linear Gain	12.7	12.4	12.7	13.1	13.1	12.4	dB
Output Power	151	147	150	152	140	131	W
Power Gain	10.8	10.6	10.7	10.7	10.5	10.2	dB
Power Added Efficiency	44	42	44	43	45	45	%

Note: Measured in CGHV96100F2-AMP (838179) under 100  $\mu\text{s}$  pulse width, 10% duty, Pin 41.0 dBm (12.6 W)

### Features

- 8.4 - 9.6 GHz Operation
- 145 W  $P_{\text{OUT}}$  typical
- 10 dB Power Gain
- 45 % Typical PAE
- 50 Ohm Internally Matched
- <0.3 dB Power Droop

### Applications

- Marine Radar
- Weather Monitoring
- Air Traffic Control
- Maritime Vessel Traffic Control
- Port Security

Large Signal Models Available for ADS and MWO

## Absolute Maximum Ratings (not simultaneous)

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	$V_{DSS}$	100	Volts	25°C
Gate-source Voltage	$V_{GS}$	-10, +2	Volts	25°C
Power Dissipation	$P_{DISS}$	115.2 / 222.0	Watts	(CW / Pulse)
Storage Temperature	$T_{STG}$	-65, +150	°C	
Operating Junction Temperature	$T_J$	225	°C	
Maximum Drain Current <sup>1</sup>	$I_{DMAX}$	12	Amps	
Maximum Forward Gate Current	$I_{GMAX}$	28.8	mA	25°C
Soldering Temperature <sup>2</sup>	$T_S$	245	°C	
Screw Torque	$\tau$	40	in-oz	
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.73	°C/W	Pulse Width = 100 $\mu$ s, Duty Cycle = 10%, 85°C, $P_{DISS} = 173$ W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.07	°C/W	CW, 85°C, $P_{DISS} = 115.2$ W
Case Operating Temperature <sup>3</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> See also, the Power Dissipation De-rating Curve on Page 9.

## Electrical Characteristics (Frequency = 9.6 GHz unless otherwise stated; $T_C = 25^\circ\text{C}$ )

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	$V_{DS} = 10$ V, $I_D = 28.8$ mA
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	V	$V_{DS} = 40$ V, $I_D = 1000$ mA
Saturated Drain Current <sup>2</sup>	$I_{DS}$	21.0	26.0	-	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	$V_{BD}$	100	-	-	V	$V_{GS} = -8$ V, $I_D = 28.8$ mA
<b>RF Characteristics<sup>3</sup></b>						
Small Signal Gain	S21	10.5	12.4	-	dB	$V_{DD} = 40$ V, $I_{DQ} = 1000$ mA, $P_{IN} = -20$ dBm
Input Return Loss 1	S11	-	-5.2	-2.8	dB	$V_{DD} = 40$ V, $I_{DQ} = 1000$ mA, $P_{IN} = -20$ dBm, 8.4 - 9.4 GHz
Input Return Loss 2	S11	-	-	-3.3	dB	$V_{DD} = 40$ V, $I_{DQ} = 1000$ mA, $P_{IN} = -20$ dBm, 9.4 - 9.6 GHz
Output Return Loss	S22	-	-12.3	-6.0	dB	$V_{DD} = 40$ V, $I_{DQ} = 1000$ mA, $P_{IN} = -20$ dBm
Power Output <sup>3,4</sup>	$P_{OUT}$	100	131.0	-	W	$V_{DD} = 40$ V, $I_{DQ} = 1000$ mA, $P_{IN} = 41$ dBm
Power Added Efficiency <sup>3,4</sup>	PAE	30	45	-	%	$V_{DD} = 40$ V, $I_{DQ} = 1000$ mA, $P_{IN} = 41$ dBm
Power Gain <sup>3,4</sup>	$P_G$	-	10.2	-	dB	$V_{DD} = 40$ V, $I_{DQ} = 1000$ mA, $P_{IN} = 41$ dBm
Output Mismatch Stress	VSWR	-	-	5:1	$\Psi$	No damage at all phase angles, $V_{DD} = 40$ V, $I_{DQ} = 1000$ mA,

Notes:

<sup>1</sup> Measured on-wafer prior to packaging.

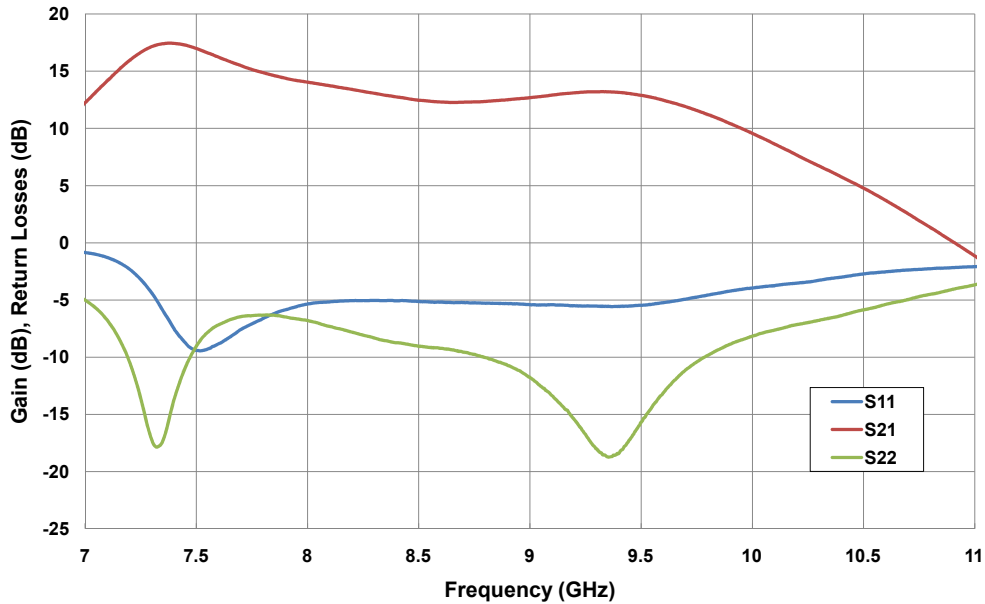
<sup>2</sup> Scaled from PCM data.

<sup>3</sup> Measured in CGHV96100F2-AMP (838179) under 100  $\mu$ s pulse width, 10% duty

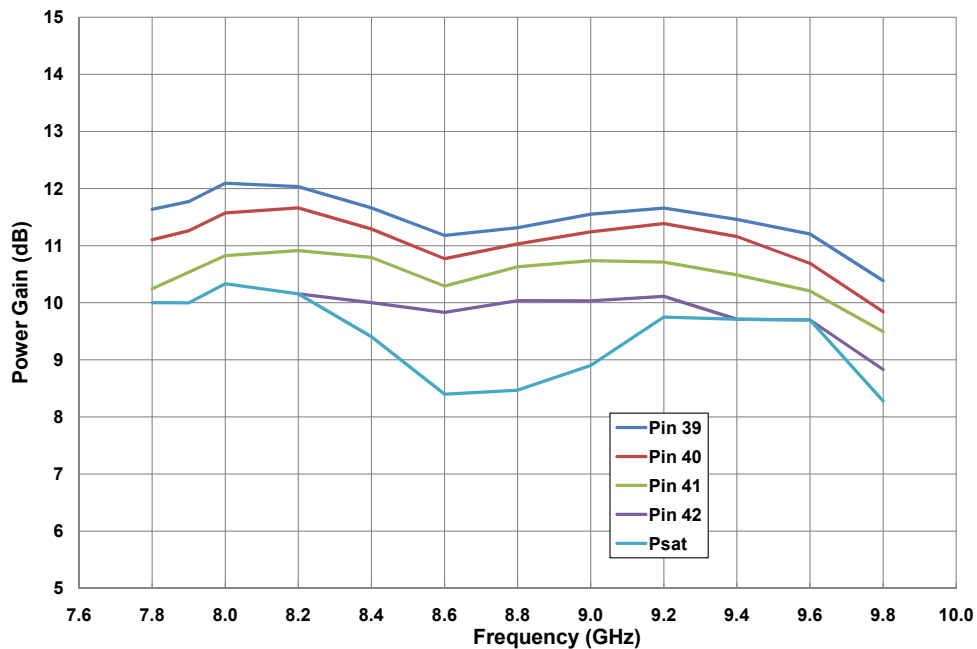
<sup>4</sup> Fixture loss de-embedded using the following offsets: Frequency = 9.6 GHz. Input = 0.5 dB and Output = 0.5 dB.

## CGHV96100F2 Typical Performance

**Figure 1. - Small Signal Gain and Return Loss vs Frequency of CGHV96100F2 measured in CGHV96100F2-AMP**  
 $V_{DS} = 40\text{ V}, I_{DQ} = 1000\text{mA}$

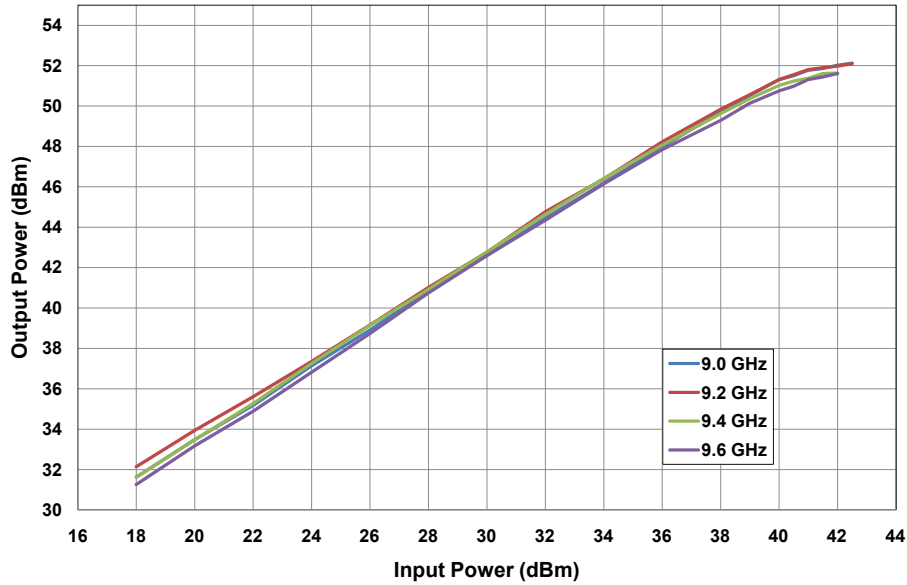


**Figure 2. - Power Gain vs. Frequency and Input Power**  
 $V_{DD} = 40\text{ V}, \text{Pulse Width} = 100\ \mu\text{sec}, \text{Duty Cycle} = 10\%$

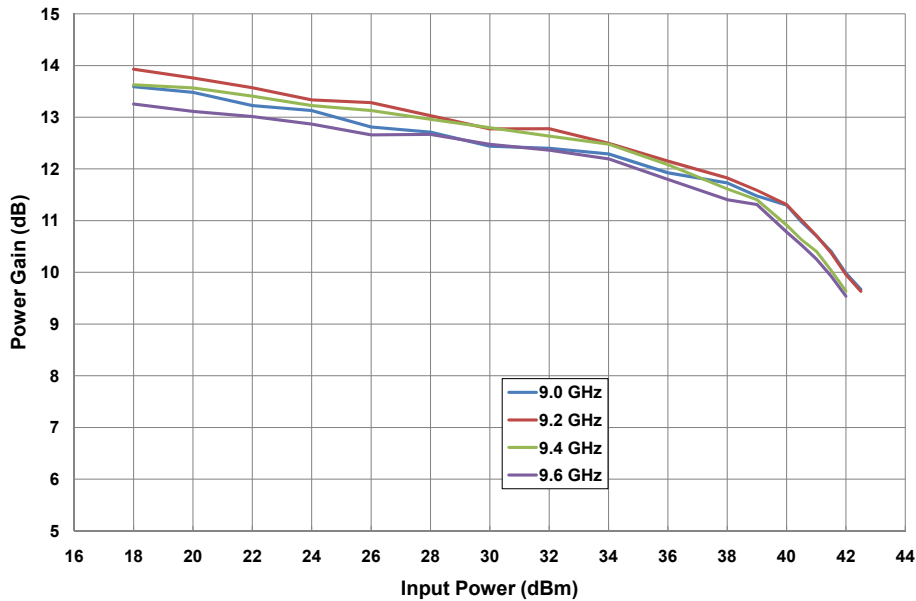


## CGHV96100F2 Typical Performance

**Figure 3. - Output Power vs. Input Power**  
 $V_{DD} = 40\text{ V}$ , Pulse Width = 100  $\mu\text{sec}$ , Duty Cycle = 10%

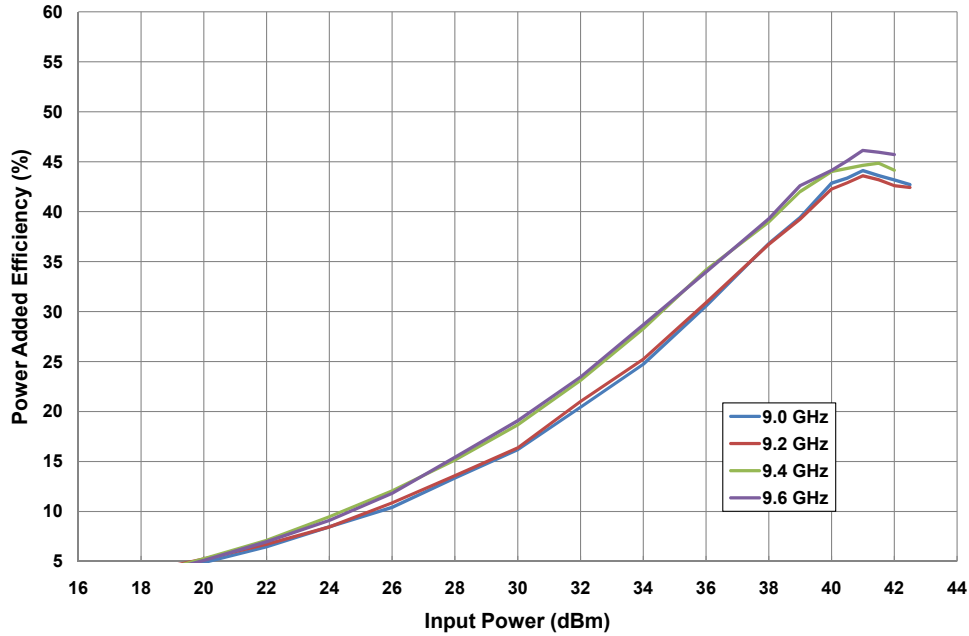


**Figure 4. - Power Gain vs. Frequency and Input Power**  
 $V_{DD} = 40\text{ V}$ , Pulse Width = 100  $\mu\text{sec}$ , Duty Cycle = 10%

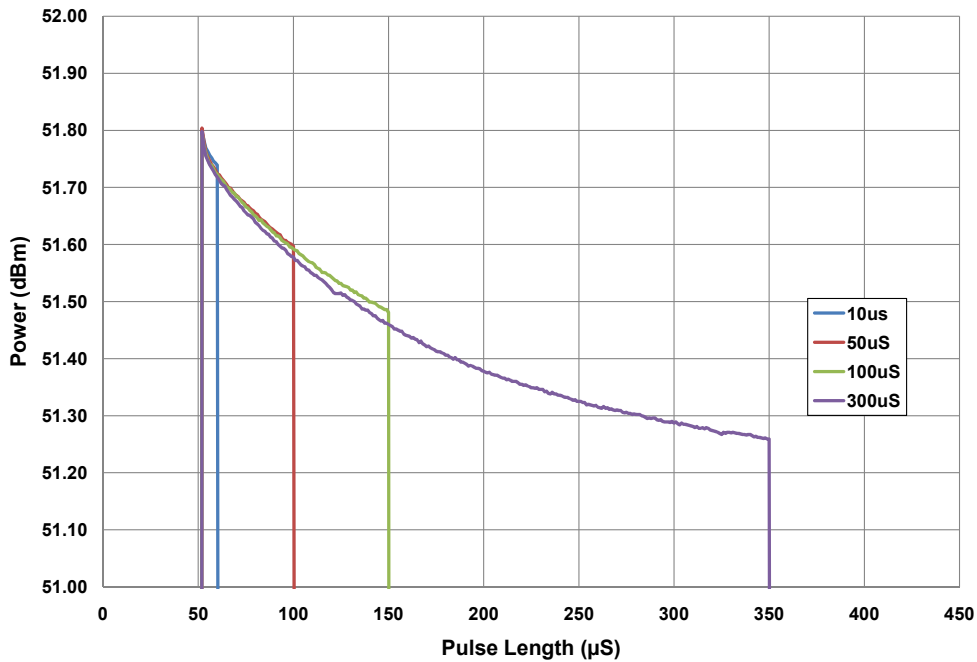


## CGHV96100F2 Typical Performance

**Figure 5. - Power Added Efficiency vs. Input Power**  
 $V_{DD} = 40\text{ V}$ , Pulse Width = 100  $\mu\text{sec}$ , Duty Cycle = 10%

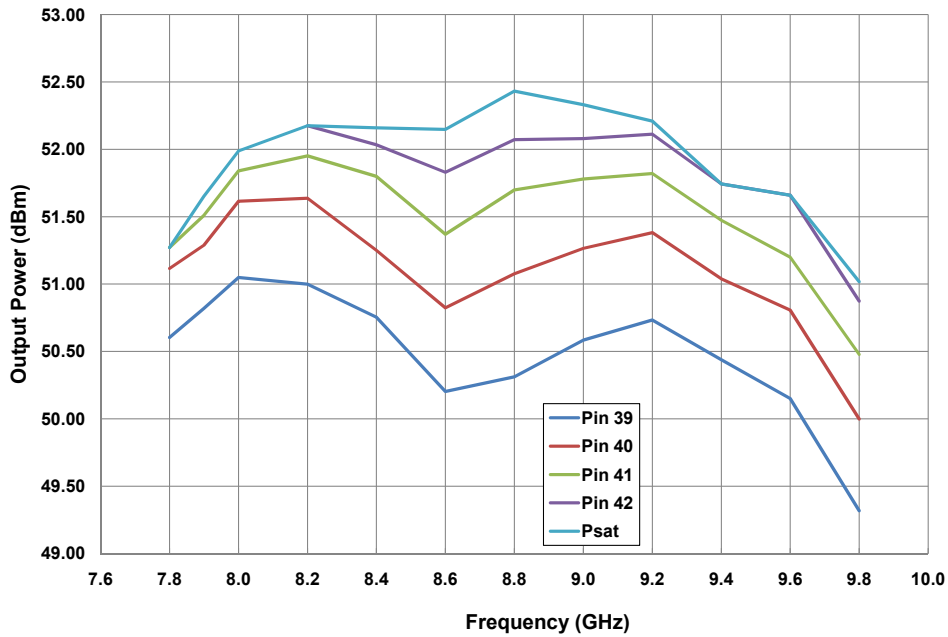


**Figure 6. - Output Power vs. Time**  
 $V_{DD} = 40\text{ V}$ ,  $P_{IN} = 41\text{ dBm}$ , Duty Cycle = 10%

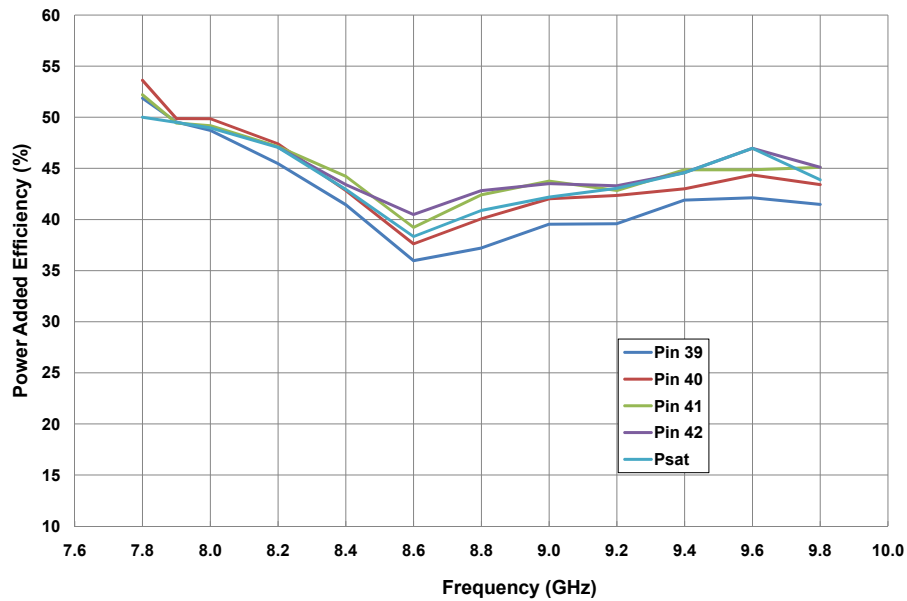


## CGHV96100F2 Typical Performance

**Figure 7. - Output Power vs. Input Power & Frequency**  
 $V_{DD} = 40\text{ V}$ , Pulse Width = 100  $\mu\text{sec}$ , Duty Cycle = 10%



**Figure 8. - Power Added Efficiency vs. Input Power & Frequency**  
 $V_{DD} = 40\text{ V}$ , Pulse Width = 100  $\mu\text{sec}$ , Duty Cycle = 10%



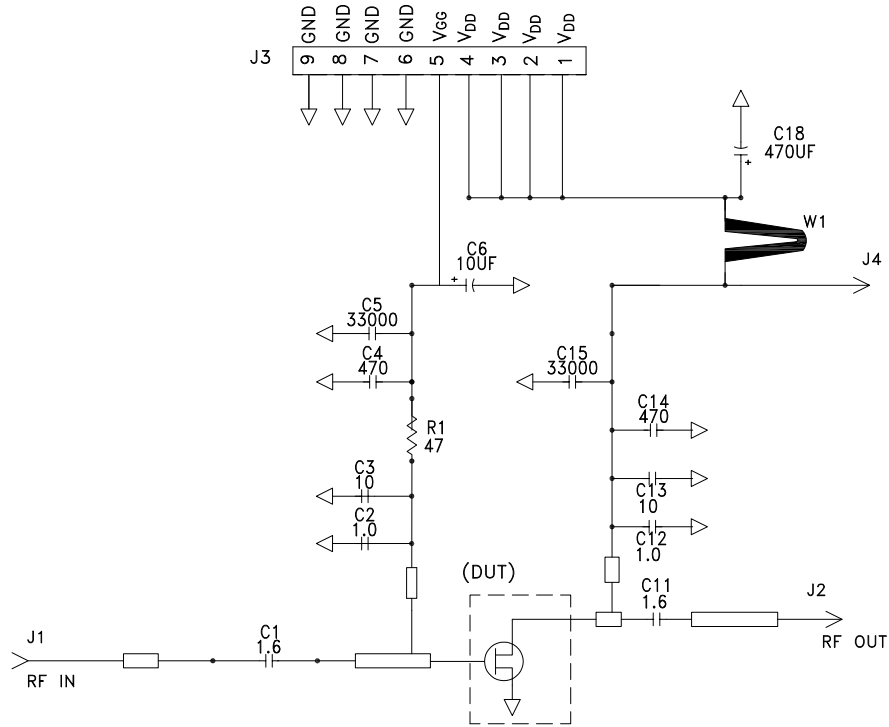
## CGHV96100F2-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 47 OHM +/-1%, 1/16 W, 0603, SMD	1
C1, C11	CAP, 1.6pF, +/- 0.1 pF, 200V, 0402, ATC 600L	2
C2, C12	CAP, 1.0pF, +/- 0.1 pF, 200V, 0402 ATC 600L	2
C3, C13	CAP, 10 pF +/-5%, 0603, ATC	2
C4, C14	CAP, 470 pF +/-5%, 100 V, 0603	2
C5, C15	CAP, 33,000 pF, 0805, 100 V, X7R	2
C6	CAP, 10 uF, 16 V, TANTALUM	1
C18	CAP, 470 uF +/-20%, ELECTROLYTIC	1
J1,J2	CONNECTOR, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST, 20MIL	2
J3	CONNECTOR, HEADER, RT>PLZ .1CEN LK 9POS	1
J4	CONNECTOR, SMB, STRAIGHT JACK	1
-	PCB, TEST FIXTURE, TACONICS RF35P, 20 MIL THK, 440210 PKG	1
-	2-56 SOC HD SCREW 1/4 SS	4
-	#2 SPLIT LOCKWASHER SS	4
Q1	CGHV96100F2	1

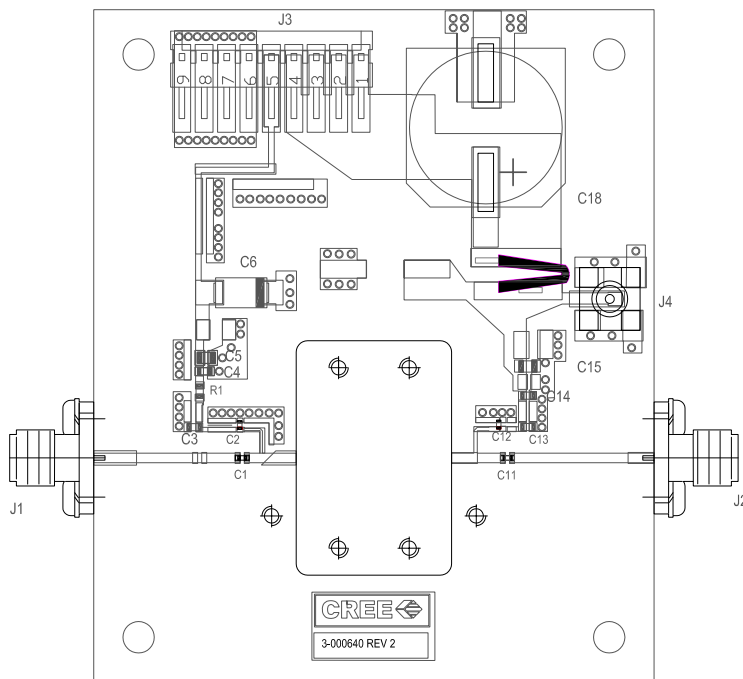
## CGHV96100F2-AMP Demonstration Amplifier Circuit



## CGHV96100F2-AMP Demonstration Amplifier Circuit Schematic

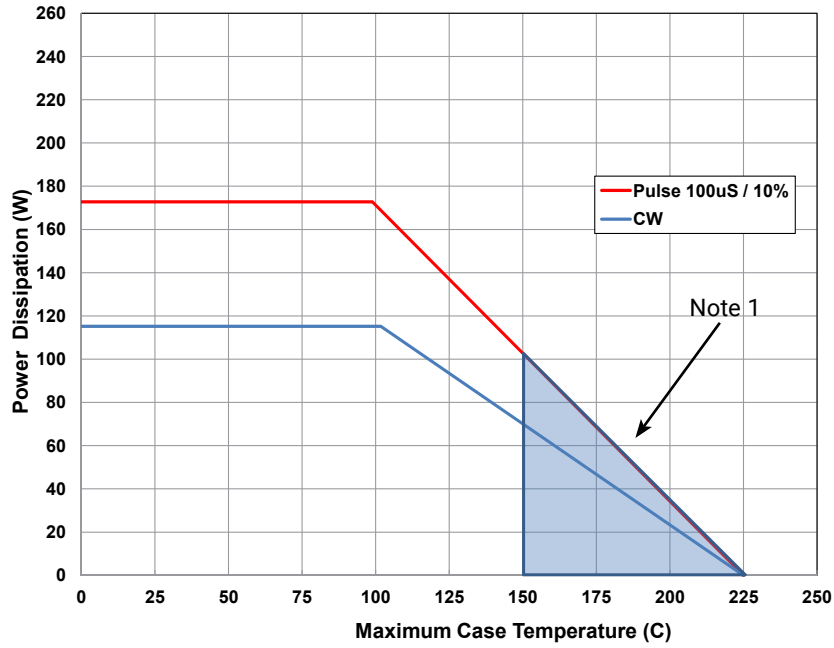


## CGHV96100F2-AMP Demonstration Amplifier Circuit Outline



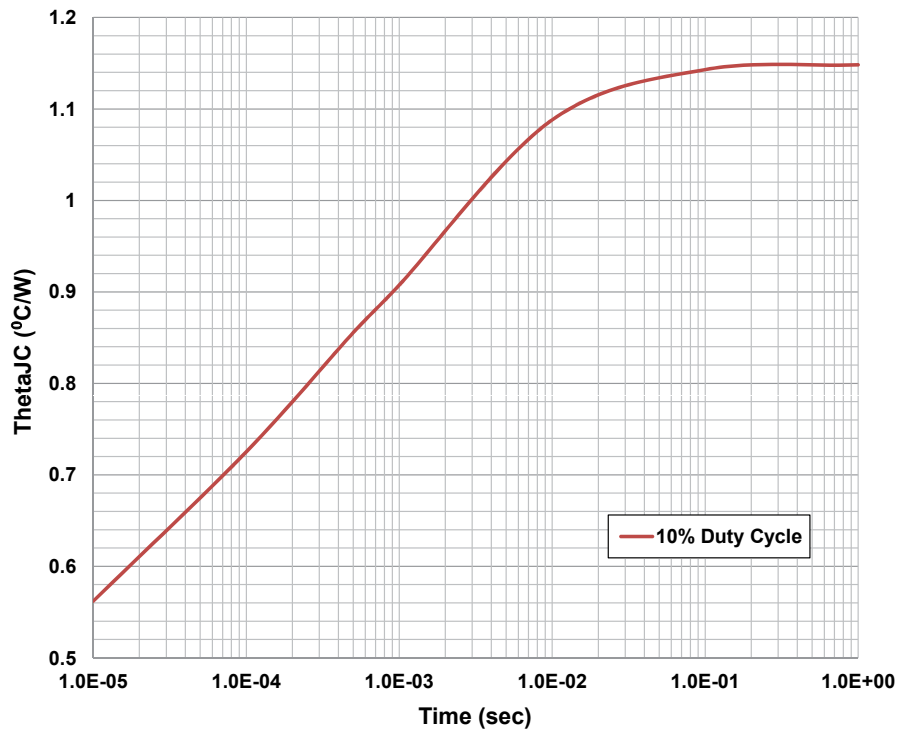


## CGHV96100F2 Power Dissipation De-rating Curve



Note 1 : Shaded area exceeds Maximum Case Operating Temperature (See Page 2)

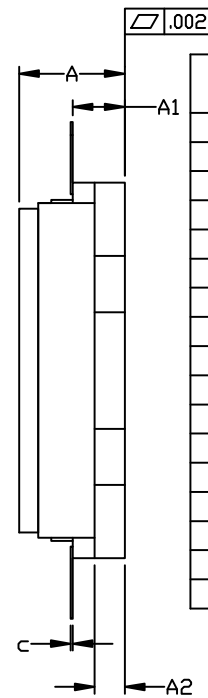
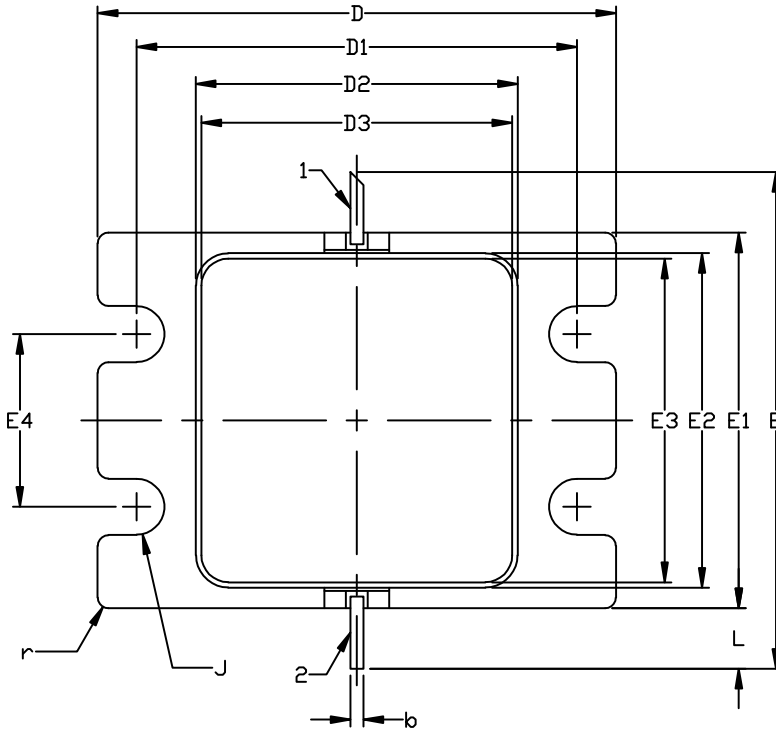
## CGHV96100F2 Transient Curve



## Product Dimensions CGHV96100F2 (Package Type – 440210)

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. INTERPRET DRAWING IN ACCORDANCE WITH ANSI Y14.5M-2009
2. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF .020 BEYOND EDGE OF LID
3. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF .008 IN ANY DIRECTION
4. ALL PLATED SURFACES ARE GOLD OVER NICKEL

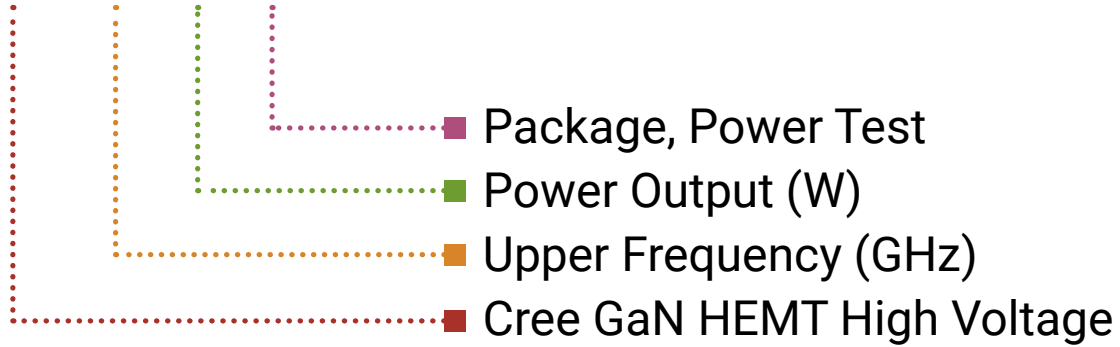


1. GATE
2. DRAIN

DIM	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.188	0.198	4.78	5.03	
A1	0.088	0.100	2.24	2.54	2x
A2	0.049	0.061	1.24	1.55	
b	0.022	0.026	0.56	0.66	2x
c	0.002	0.006	0.05	0.15	
D	0.935	0.955	23.75	24.26	
D1	0.797	0.809	20.24	20.55	2x
D2	0.581	0.593	14.76	15.06	
D3	0.563	0.571	14.30	14.50	
E	0.906		23.01		REF
E1	0.679	0.691	17.25	17.55	
E2	0.604	0.616	15.34	15.65	
E3	0.586	0.594	14.88	15.09	
E4	0.309	0.321	7.85	8.15	2x
J	∅0.097	∅0.107	∅2.46	∅2.72	4x
L	0.090	0.130	2.29	3.30	2x
r	0.02 TYP		0.51 TYP		12x

## Part Number System

**CGHV96100F2**



Parameter	Value	Units
Upper Frequency <sup>1</sup>	9.6	GHz
Power Output	100	W
Package	Flange	-

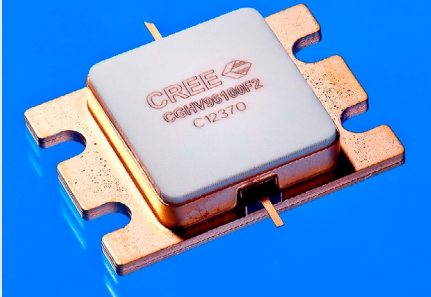
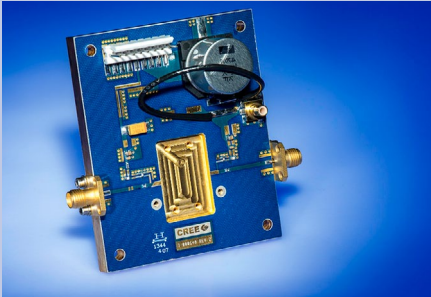
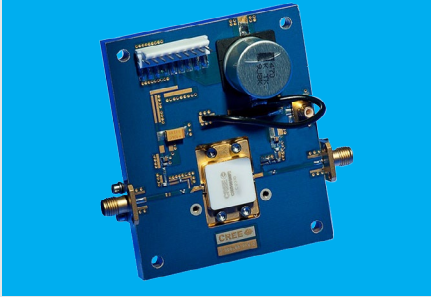
**Table 1.**

**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
CGHV96100F2	GaN HEMT	Each	
CGHV96100F2-TB	GaN HEMT	Each	
CGHV96100F2-AMP	Test board without GaN HEMT	Each	
CGHV96100F2-JMT	Delivered in a JEDEC Matrix tray	TBD parts / tray	



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