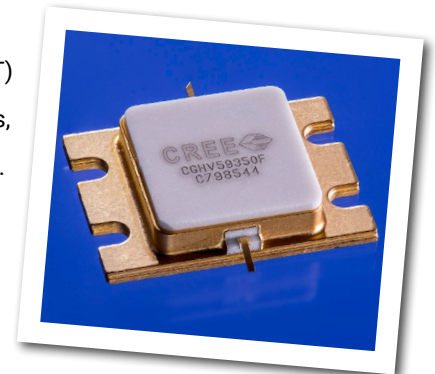


# CGHV59350

## 350 W, 5200 - 5900 MHz, 50-Ohm Input/Output Matched, GaN HEMT for C-Band Radar Systems

Cree's CGHV59350 is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV59350 ideal for 5.2 - 5.9 GHz C-Band radar amplifier applications. The transistor is supplied in a ceramic/metal flange package, type 440217 and 440218.



PN: CGHV59350  
Package Type: 440217 and 440218

### Typical Performance Over 5.2 - 5.9 GHz ( $T_c = 25^\circ\text{C}$ ) of Demonstration Amplifier

Parameter	5.2 GHz	5.55 GHz	5.9 GHz	Units
Output Power	468	475	468	W
Gain	10.7	10.8	10.7	dB
Drain Efficiency	68	62	59	%

**Note:**

Measured in the CGHV59350-AMP under 100  $\mu\text{s}$  pulse width, 10% duty cycle,  $P_{IN} = 46 \text{ dBm}$

### Features

- 5.2 - 5.9 GHz Operation
- 470 W Typical Output Power
- 10.7 dB Power Gain
- 60% Typical Drain Efficiency
- 50 Ohm Internally Matched
- <0.3 dB Pulsed Amplitude Droop

## Absolute Maximum Ratings (not simultaneous)

Parameter	Symbol	Rating	Units	Conditions
Pulse Width	PW	100	μs	
Duty Cycle	DC	10	%	
Drain-Source Voltage	V <sub>DSS</sub>	125	Volts	25°C
Gate-to-Source Voltage	V <sub>GS</sub>	-10, +2	Volts	25°C
Storage Temperature	T <sub>STG</sub>	-65, +150	°C	
Operating Junction Temperature	T <sub>J</sub>	225	°C	
Maximum Forward Gate Current	I <sub>GMAX</sub>	64	mA	25°C
Maximum Drain Current <sup>1</sup>	I <sub>DMAX</sub>	24	A	25°C
Soldering Temperature <sup>2</sup>	T <sub>S</sub>	245	°C	
Screw Torque	τ	40	in-oz	
Pulsed Thermal Resistance, Junction to Case	R <sub>θJC</sub>	0.31	°C/W	100 μsec, 10%, 85°C, P <sub>DISS</sub> = 320 W
Case Operating Temperature <sup>3</sup>	T <sub>C</sub>	-40, +125	°C	

Notes:

<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/tools-and-support/document-library>

<sup>3</sup> Refer to Figure 5

## Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics<sup>1</sup> (T<sub>c</sub> = 25°C)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	-3.8	-3.0	-2.3	V <sub>DC</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 64 mA
Gate Quiescent Voltage	V <sub>GS(Q)</sub>	-	-2.7	-	V <sub>DC</sub>	V <sub>DS</sub> = 50 V, I <sub>D</sub> = 1.0 A
Saturated Drain Current <sup>2</sup>	I <sub>DS</sub>	48	57.8	-	A	V <sub>DS</sub> = 6.0 V, V <sub>GS</sub> = 2.0 V
Drain-Source Breakdown Voltage	V <sub>BR</sub>	150	-	-	V <sub>DC</sub>	V <sub>GS</sub> = -8 V, I <sub>D</sub> = 64 mA

Notes:

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

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

## Electrical Characteristics Continued...

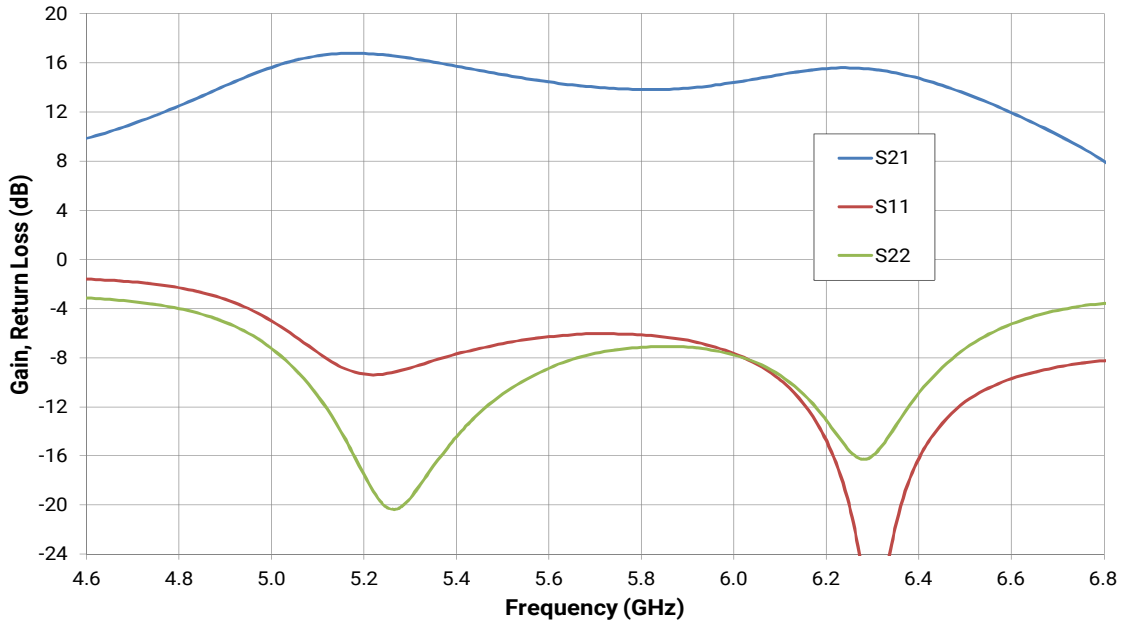
Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>RF Characteristics<sup>3</sup> (T<sub>c</sub> = 25 °C, F<sub>0</sub> = 5.2 - 5.9 GHz unless otherwise noted)</b>						
Output Power at 5.2 GHz	P <sub>OUT1</sub>	389	466	–	W	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm
Output Power at 5.4 GHz	P <sub>OUT2</sub>	335	499	–	W	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm
Output Power at 5.8 GHz	P <sub>OUT3</sub>	302	446	–	W	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm
Output Power at 5.9 GHz	P <sub>OUT4</sub>	302	468	–	W	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm
Gain at 5.2 GHz	G <sub>P1</sub>	–	10.7	–	dB	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm
Gain at 5.4 GHz	G <sub>P2</sub>	–	11	–	dB	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm
Gain at 5.8 GHz	G <sub>P3</sub>	–	10.5	–	dB	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm
Gain at 5.9 GHz	G <sub>P4</sub>	–	10.7	–	dB	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm
Drain Efficiency at 5.2 GHz	D <sub>E1</sub>	53	68	–	%	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm
Drain Efficiency at 5.4 GHz	D <sub>E2</sub>	46	67	–	%	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm
Drain Efficiency at 5.8 GHz	D <sub>E3</sub>	40	58	–	%	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm
Drain Efficiency at 5.9 GHz	D <sub>E4</sub>	40	59	–	%	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm
Small Signal Gain	S21	11.50	15	–	dB	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = -10 dBm
Input Return Loss	S11	–	-7	-3	dB	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = -10 dBm
Output Return Loss	S22	–	-11	-3	dB	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = -10 dBm
Amplitude Droop	D	–	-0.3	–	dB	V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm
Output Stress Match	VSWR	–	5:1	–	Ψ	No damage at all phase angles, V <sub>DD</sub> = 50 V, I <sub>DQ</sub> = 1 A, P <sub>IN</sub> = 46 dBm Pulsed

Notes:

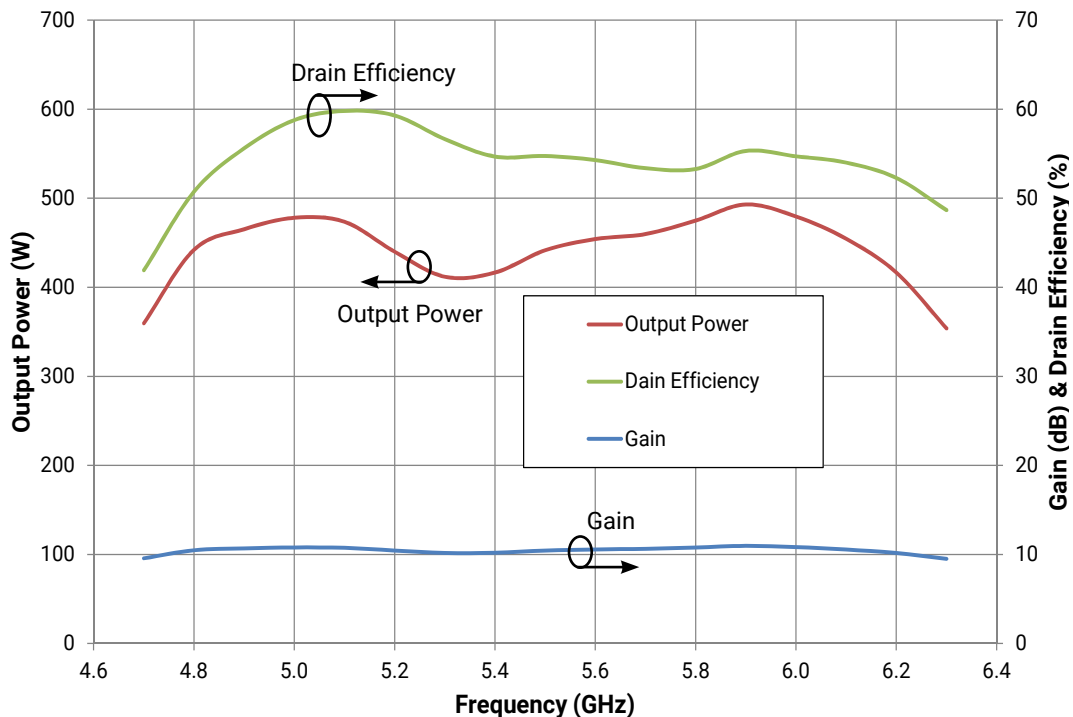
<sup>3</sup> Measured in CGHV59350-AMP. Pulse Width = 100 μs, Duty Cycle = 10%.

## Typical Performance

**Figure 1. - Small Signal S-Parameters  
CGHV59350 in Test Fixture  
 $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 1\text{ A}$ ,  $T_{case} = 25\text{ }^{\circ}\text{C}$**



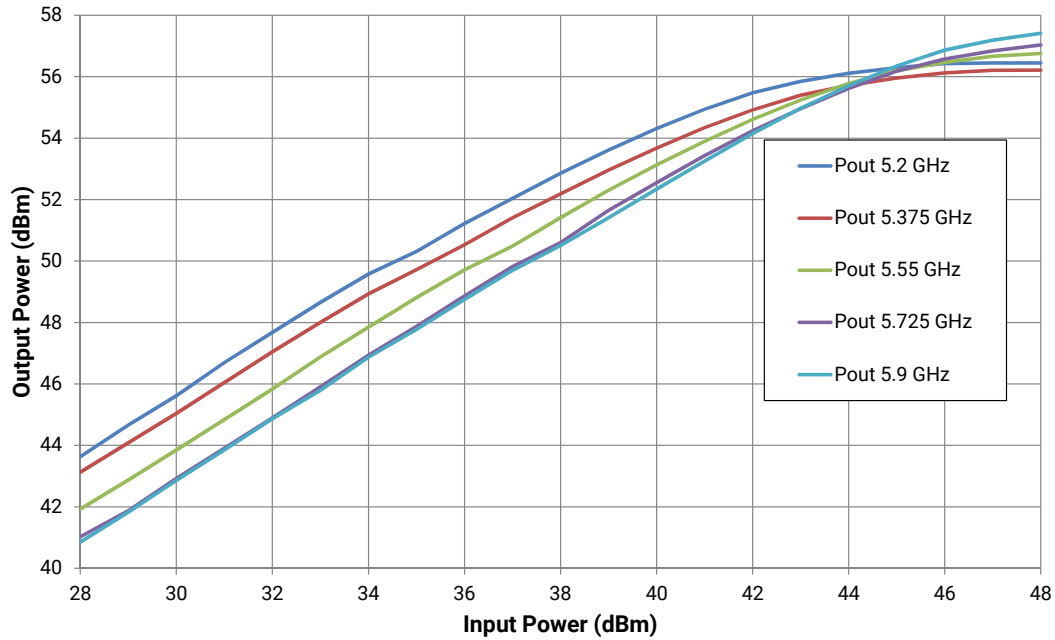
**Figure 2. - CGHV59350 Pout,  $D_{Eff}$  and Gain vs. Frequency at  $T_{case} = 25\text{ }^{\circ}\text{C}$   
 $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 1.0\text{ A}$ ,  $P_{IN} = 46\text{ dBm}$ , Pulse Width =  $100\mu\text{S}$ , Duty Cycle = 10%**



## Typical Performance

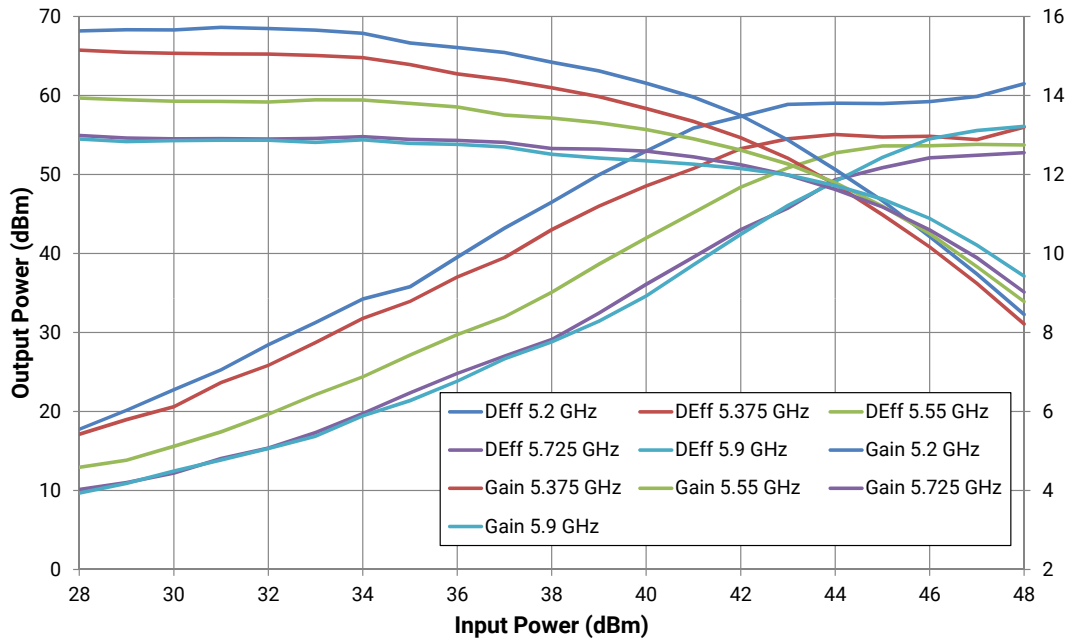
**Figure 3. - CGHV59350 Output Power vs. Input Power**

$V_{DD} = 50V, I_{DQ} = 1.0 A, \text{Pulse Width} = 100\mu S, \text{Duty Cycle} = 10\%, T_{case} = 25^\circ C$



**Figure 4. - CGHV59350 Output Power vs. Input Power**

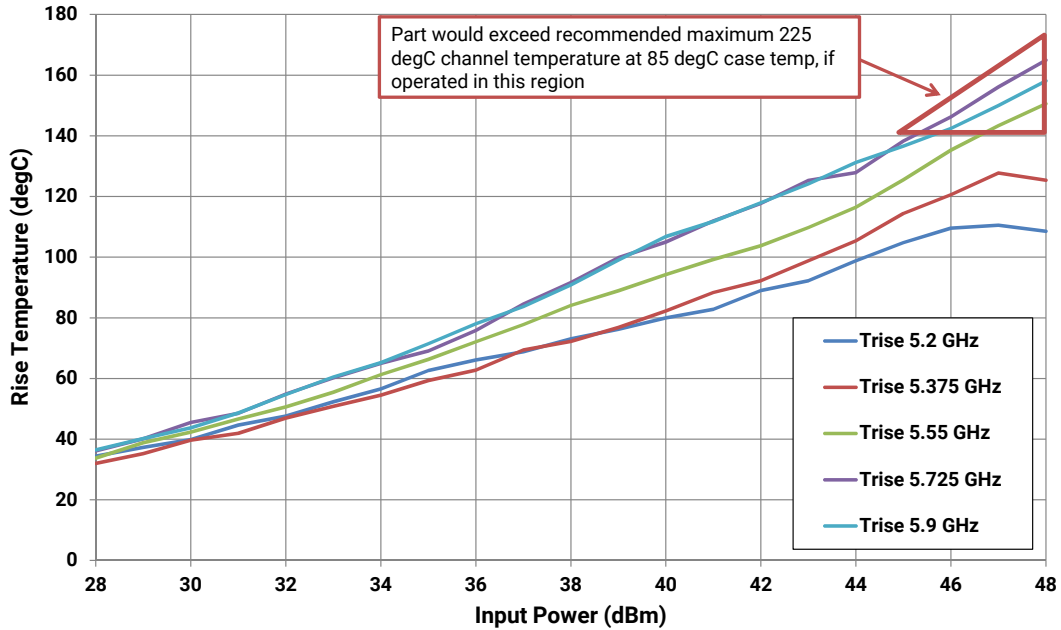
$V_{DD} = 50V, I_{DQ} = 1.0 A, \text{Pulse Width} = 100\mu S, \text{Duty Cycle} = 10\%, T_{case} = 25^\circ C$



## Typical Performance

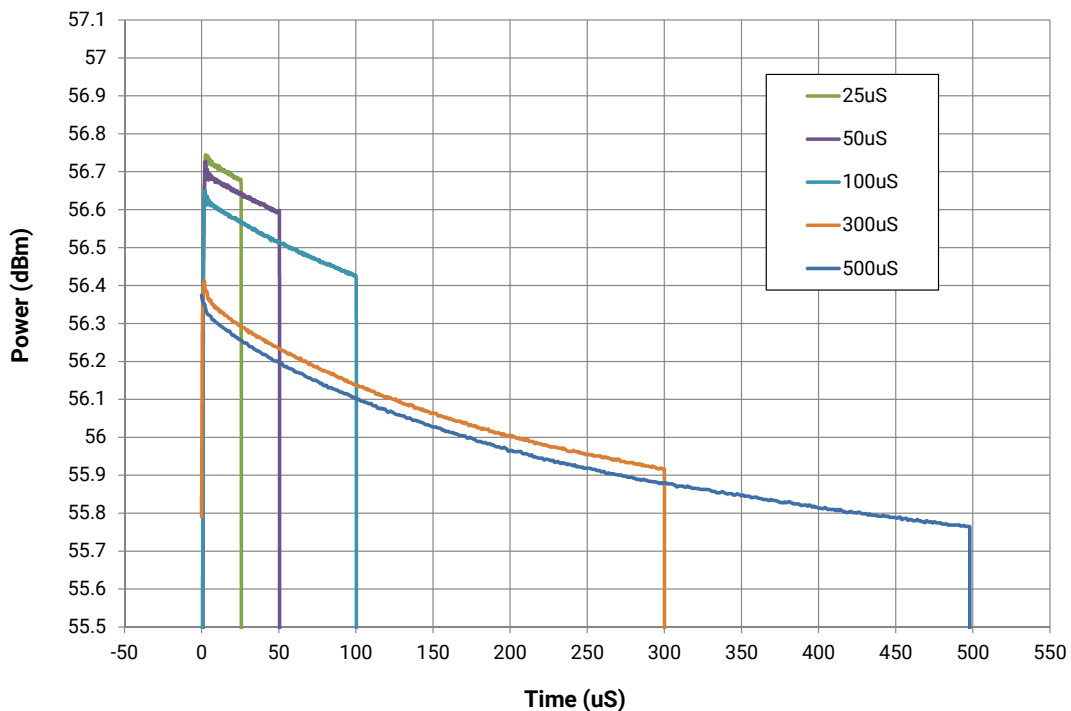
**Figure 5. - CGHV59350 Output Power vs. Input Power**

$V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 1\text{ A}$ , Pulse Width = 100  $\mu\text{s}$ , Duty Cycle = 10 %,  $T_{case} = 25\text{ }^\circ\text{C}$



**Figure 6. - CGHV59350 Output Power vs. Time**

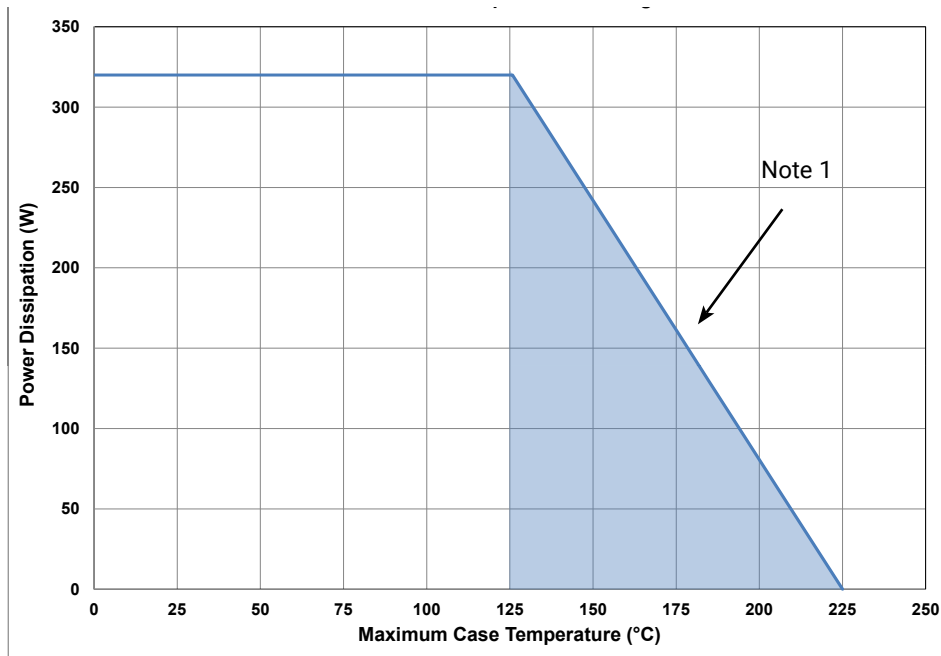
$V_{DD} = 50\text{ V}$ ,  $P_{IN} = 46\text{ dBm}$ , Duty Cycle = 10%



## CGHV59350-AMP Application Circuit Bill of Materials

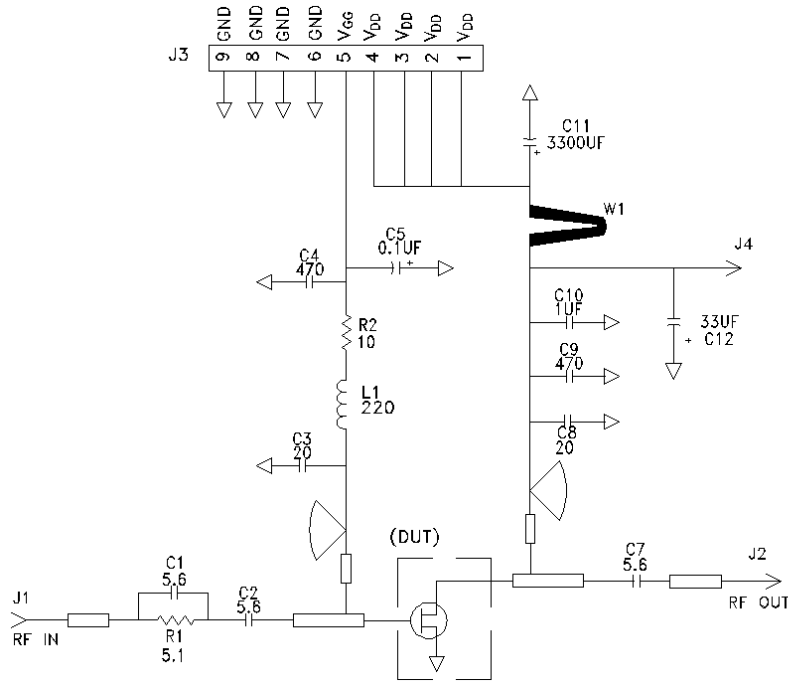
Designator	Description	Qty
R1	RES, 5.10HM, +/- 1%, 1/16W,0603	1
R2	RES, 100HM, +/- 1%, 1/16W,0603	1
C1,C2	CAP, 5.6pF, +/- 0.25 pF,250V, 0603	2
C3,C8	CAP, 20pF, +/- 0.25 pF,250V, 0603	2
C4,C9	CAP, 470PF, 5%, 100V, 0603, X	2
C5	CAP, 0.1MF, 1206, 250 V, X7R	1
L1	IND, FERRITE, 220 OHM, 0603	1
C10	CAP, 1.0UF, 100V, 10%, X7R, 1210	1
C7	CAP, 5.6pF, +/- 0.25 pF,250V, 0603	1
C11	CAP, 3300 UF, +/-20%, 100V, ELECTROLYTIC	1
C12	CAP, 33 UF, 20%, G CASE	1
J1,J2	CONN, SMA, PANEL MOUNT JACK, FL	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
J4	CONNECTOR ; SMB, Straight, JACK,SMD	1
W1	CABLE ,18 AWG, 4.2	1
-	PCB, TEST FIXTURE, TACONIC RF35P 20MIL OVER 0.250 COPPER BACK, 2.5 X 3 X 0.26", CGHV59350-TB	1
-	2-56 SOC HD SCREW 1/4 SS	4
-	#2 SPLIT LOCKWASHER SS	4
Q1	CGHV59350	1

## CGHV59350 Power Dissipation De-rating Curve

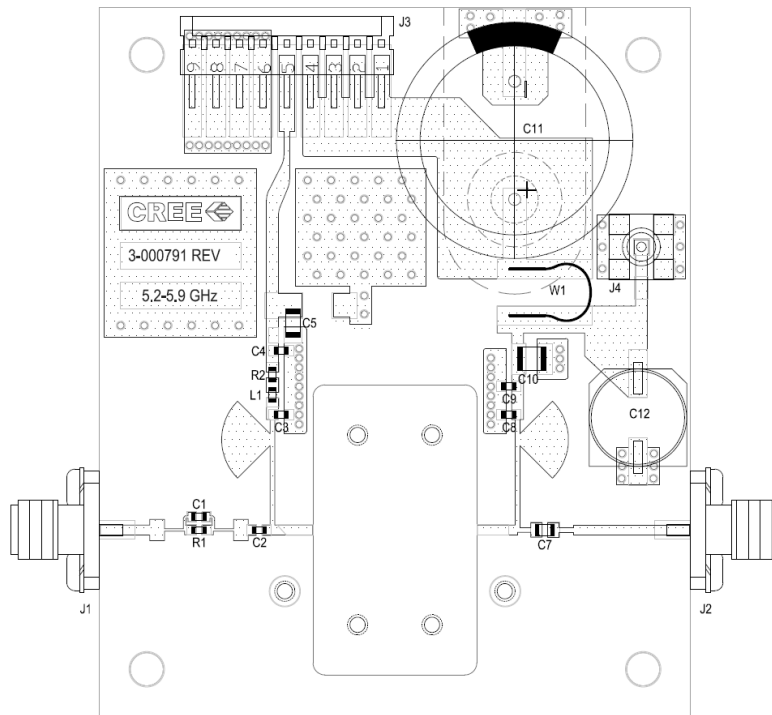


Note 1. Area exceeds Maximum Case Temperature (See Page 2).

## CGHV59350-AMP Application Circuit Schematic



## CGHV59350-AMP Application Circuit Outline

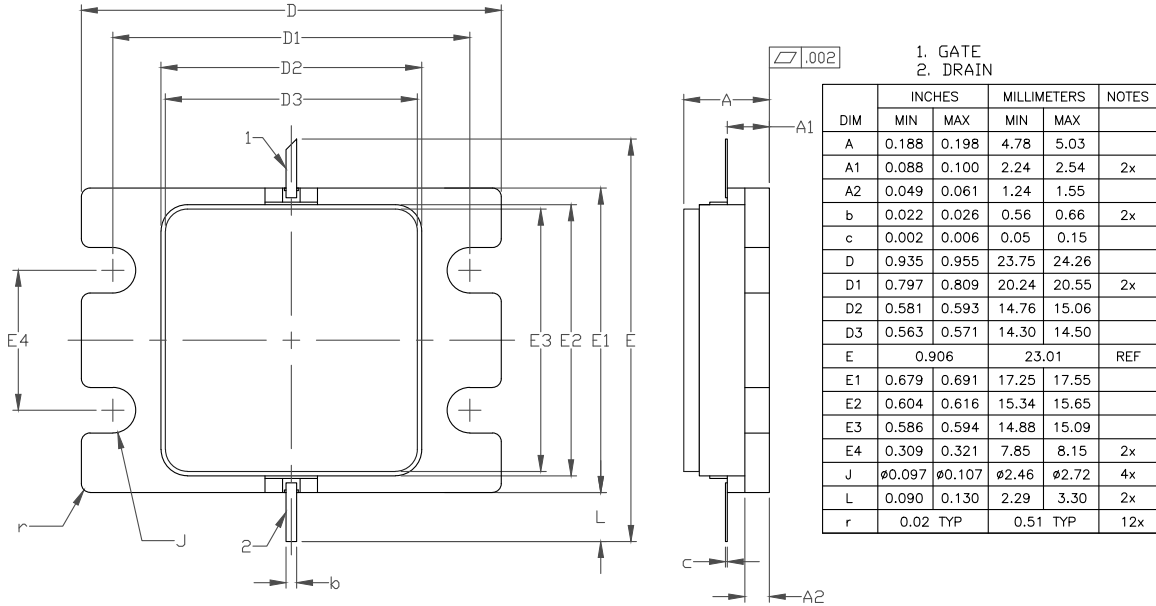




## Product Dimensions CGHV59350F (Package Type – 440217)

NOTES: (UNLESS OTHERWISE SPECIFIED)

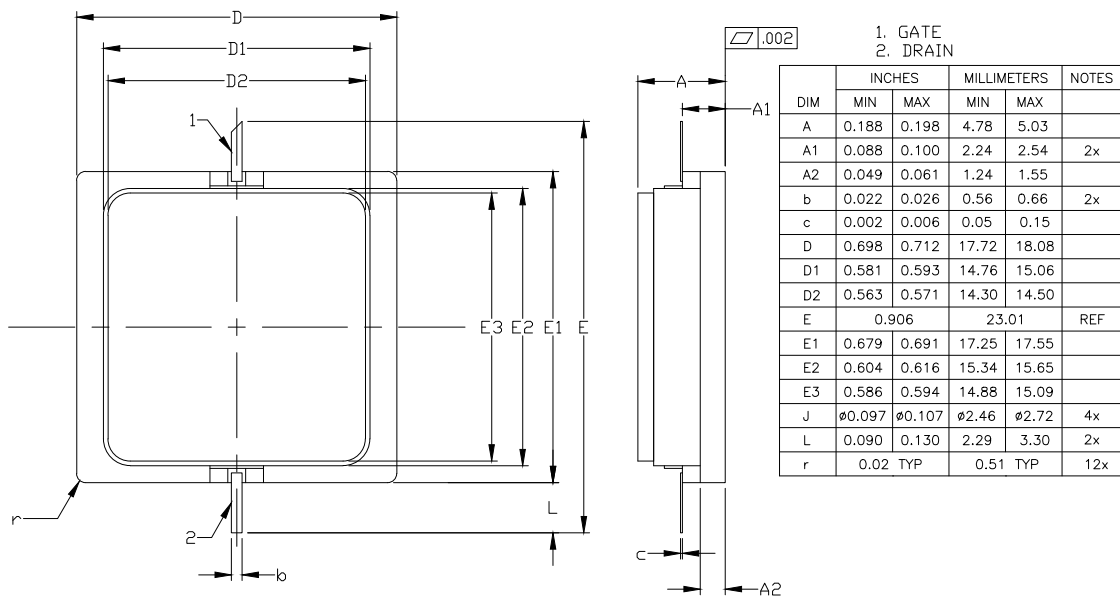
1. INTERPRET DRAWING IN ACCORDANCE WITH ANSI Y14.5M-2009
2. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF .020 BEYOND EDGE OF LID
3. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF .008 IN ANY DIRECTION
4. ALL PLATED SURFACES ARE GOLD OVER NICKEL



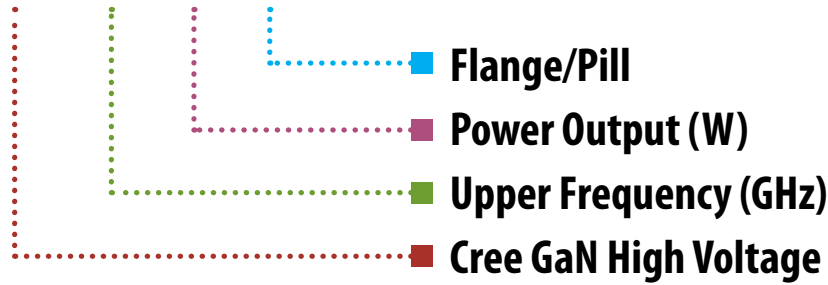
## Product Dimensions CGHV59350P (Package Type – 440218)

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



### CGHV59350F/P



Parameter	Value	Units
Upper Frequency <sup>1</sup>	5.9	GHz
Power Output	350	W
Package	Flange/Pill	-

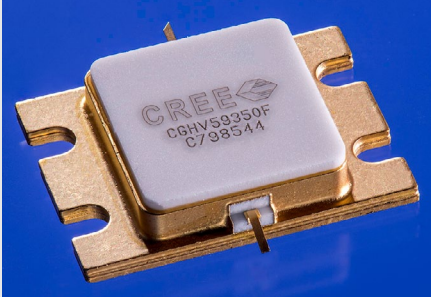

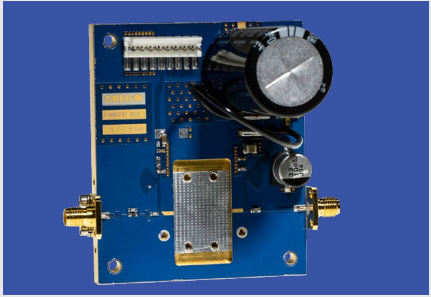
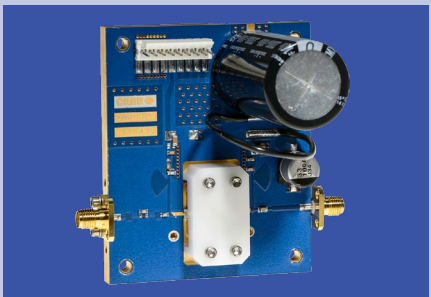
**Table 1.**

**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
CGHV59350F	GaN HEMT	Each	
CGHV59350P	GaN HEMT	Each	
CGHV59350-TB	Test board without GaN HEMT	Each	
CGHV59350-AMP	Test board with GaN HEMT installed	Each	



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