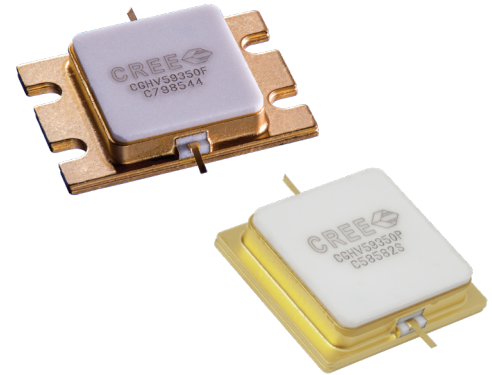


CGHV59350

350 W, 5.2 - 5.9 GHz, 50-Ohm Input/Output Matched, GaN HEMT for C-Band Radar Systems



PN: CGHV59350F and CGHV59350P
Package Type: 440217 and 440218

Description

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 or pill package.

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 μs 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 PAE
- 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 _{DSS}	150	Volts	25 °C
Gate-to-Source Voltage	V _{GS}	-10, +2	Volts	25 °C
Storage Temperature	T _{STG}	-65, +150	°C	
Operating Junction Temperature	T _J	225	°C	
Maximum Forward Gate Current	I _{GMAX}	64	mA	25 °C
Maximum Drain Current ¹	I _{DMAX}	24	A	25 °C
Soldering Temperature ²	T _S	245	°C	
Screw Torque	τ	40	in-oz	
Pulsed Thermal Resistance, Junction to Case	R _{θJC}	0.31	°C/W	100 μsec, 10%, 85 °C, P _{DISS} = 320 W
Case Operating Temperature ³	T _C	-40, +125	°C	

Notes:

¹ Current limit for long term, reliable operation

² Refer to the Application Note on soldering at wolfspeed.com/rf/document-library

³ Refer to Figure 5 and Power Derating Curve on page 9

Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics¹ (T_C = 25 °C)						
Gate Threshold Voltage	V _{GS(th)}	-3.8	-3.0	-2.3	V _{DC}	V _{DS} = 10 V, I _D = 64 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}	41.6	59.5	-	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 = 64 mA

Notes:

¹ Measured on wafer prior to packaging

² Scaled from PCM data

Electrical Characteristics Continued

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
RF Characteristics³ (T_c = 25 °C, F₀ = 5.2 - 5.9 GHz unless otherwise noted)						
Output Power at 5.2 GHz	P _{OUT1}	389	466	-	W	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm
Output Power at 5.4 GHz	P _{OUT2}	335	499	-	W	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm
Output Power at 5.8 GHz	P _{OUT3}	302	446	-	W	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm
Output Power at 5.9 GHz	P _{OUT4}	302	468	-	W	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm
Gain at 5.2 GHz	G _{P1}	-	10.7	-	dB	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm
Gain at 5.4 GHz	G _{P2}	-	11	-	dB	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm
Gain at 5.8 GHz	G _{P3}	-	10.5	-	dB	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm
Gain at 5.9 GHz	G _{P4}	-	10.7	-	dB	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm
Drain Efficiency at 5.2 GHz	D _{E1}	53	68	-	%	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm
Drain Efficiency at 5.4 GHz	D _{E2}	46	67	-	%	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm
Drain Efficiency at 5.8 GHz	D _{E3}	40	58	-	%	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm
Drain Efficiency at 5.9 GHz	D _{E4}	40	59	-	%	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm
Small Signal Gain	S21	11.50	15	-	dB	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = -10 dBm
Input Return Loss	S11	-	-7	-3	dB	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = -10 dBm
Output Return Loss	S22	-	-11	-3	dB	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = -10 dBm
Amplitude Droop	D	-	-0.3	-	dB	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm
Output Stress Match	VSWR	-	5:1	-	Ψ	No damage at all phase angles, V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = 46 dBm Pulsed

Note:

³ Measured in CGHV59350-AMP. Pulse Width = 100 μS, Duty Cycle = 10%



Typical Performance

Figure 1. Small Signal S-Parameters for the CGHV59350F in Test Fixture CGHV59350F-TB
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1\text{ A}$, $T_{case} = 25\text{ }^{\circ}\text{C}$

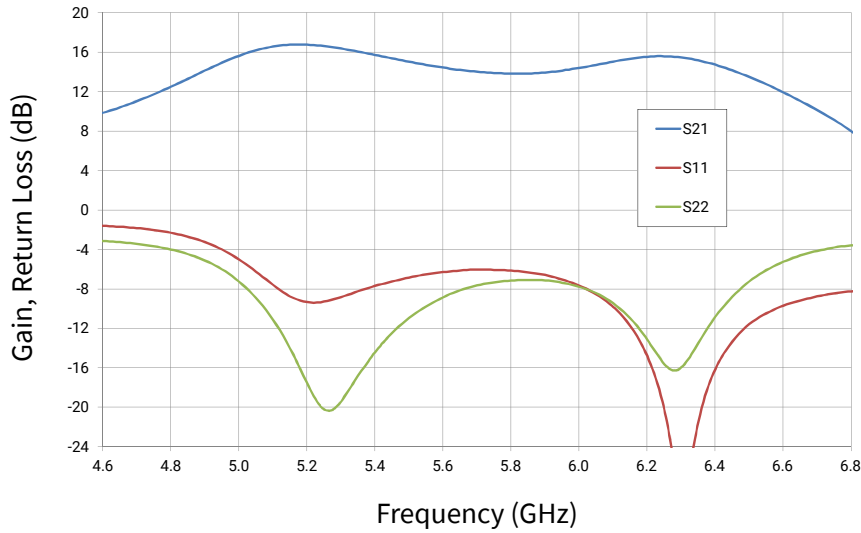
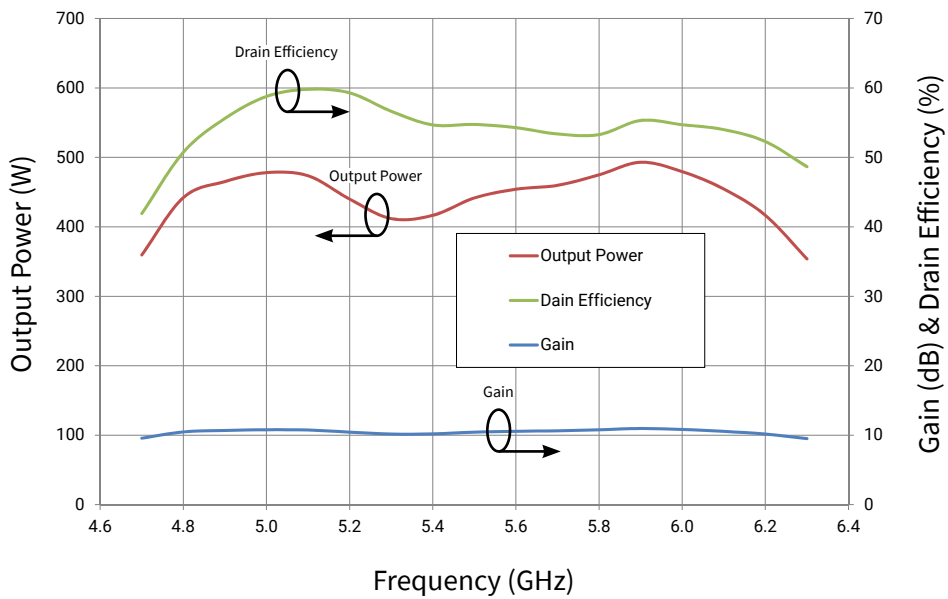


Figure 2. CGHV59350 Output Power, Drain Efficiency, and Gain vs. Frequency at $T_{case} = 25\text{ }^{\circ}\text{C}$
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$, $P_{IN} = 46\text{ dBm}$, Pulse Width = 100 μs , Duty Cycle = 10%





Typical Performance

Figure 3. CGHV59350 Output Power vs. Input Power
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$, Pulse Width = 100 μS , Duty Cycle = 10%, $T_{case} = 25\text{ }^\circ\text{C}$

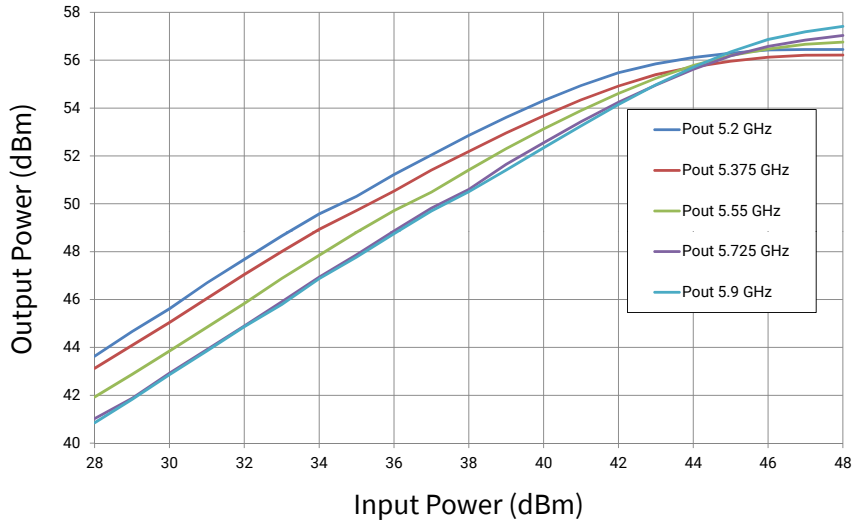
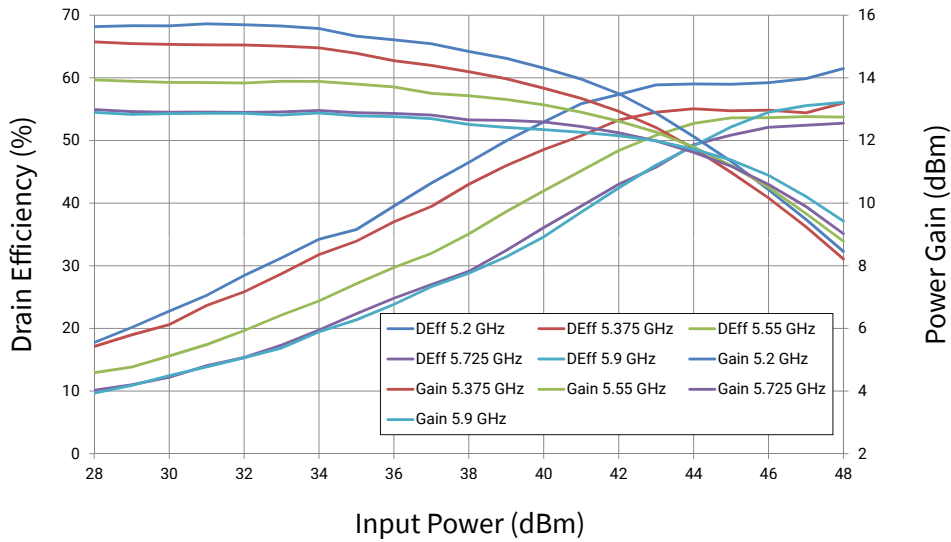


Figure 4. CGHV59350 Drain Efficiency and Gain vs. Input Power as a Function of Frequency
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$, Pulse Width = 100 μS , Duty Cycle = 10%, $T_{case} = 25\text{ }^\circ\text{C}$





Typical Performance

Figure 5. CGHV59350 Output Power vs. Input Power
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1\text{ A}$, Pulse Width = 100 μS , Duty Cycle = 10%, $T_{case} = 25\text{ }^\circ\text{C}$

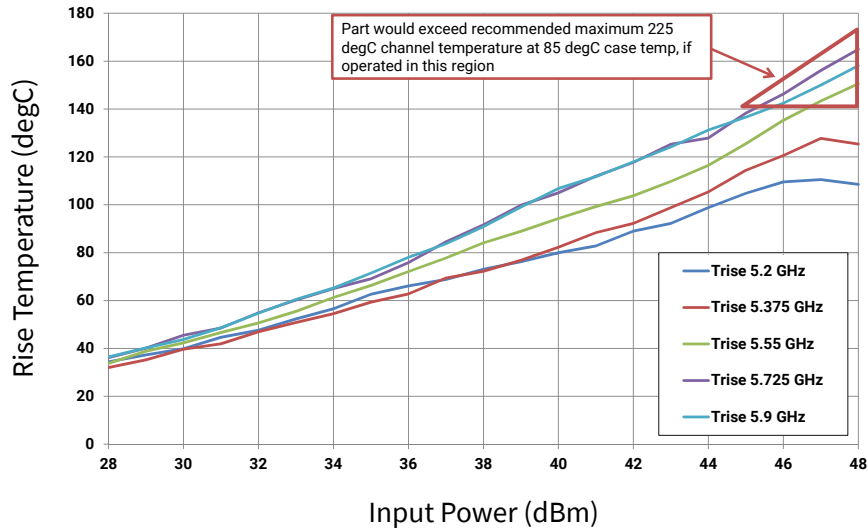
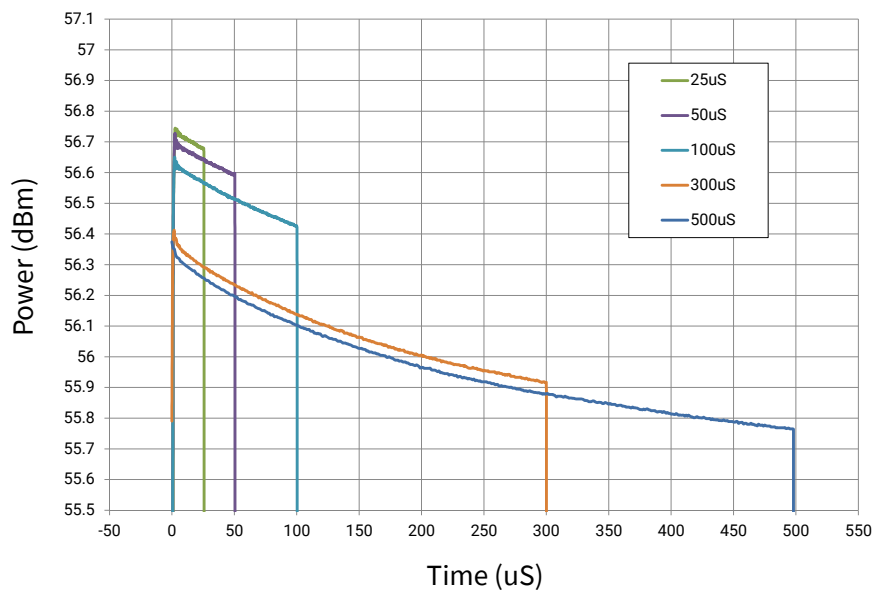


Figure 6. CGHV59350 Output Power vs. Time
 $V_{DD} = 50\text{ V}$, $P_{IN} = 46\text{ dBm}$, Duty Cycle = 10%





Typical Performance

Figure 7. CGHV59350 Output Power vs. Frequency
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1\text{ A}$, $P_{IN} = 46\text{ dBm}$, Pulse Width = $500\ \mu\text{s}$, Duty Cycle = 5%, 7%, 10%

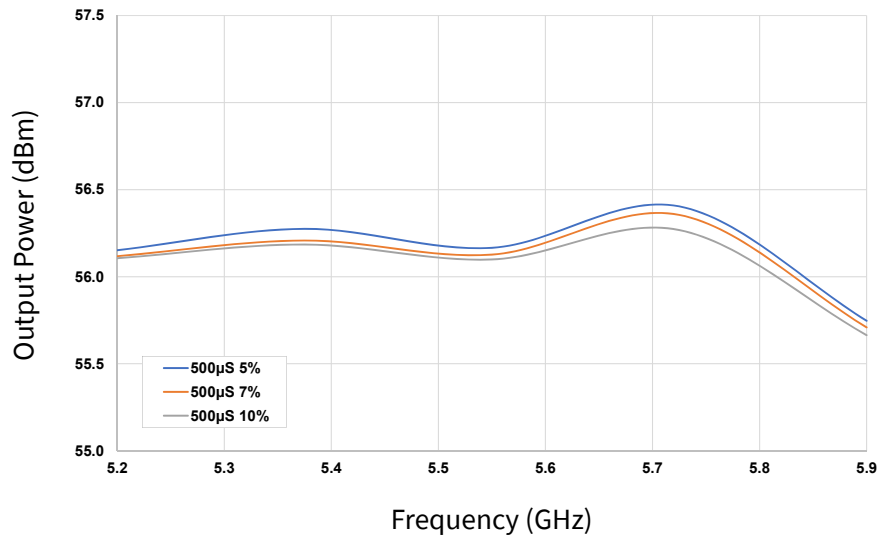
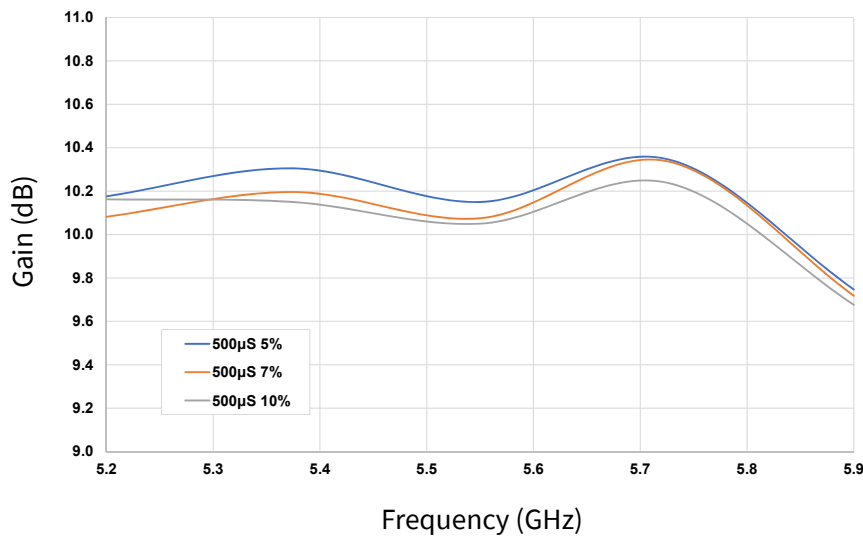


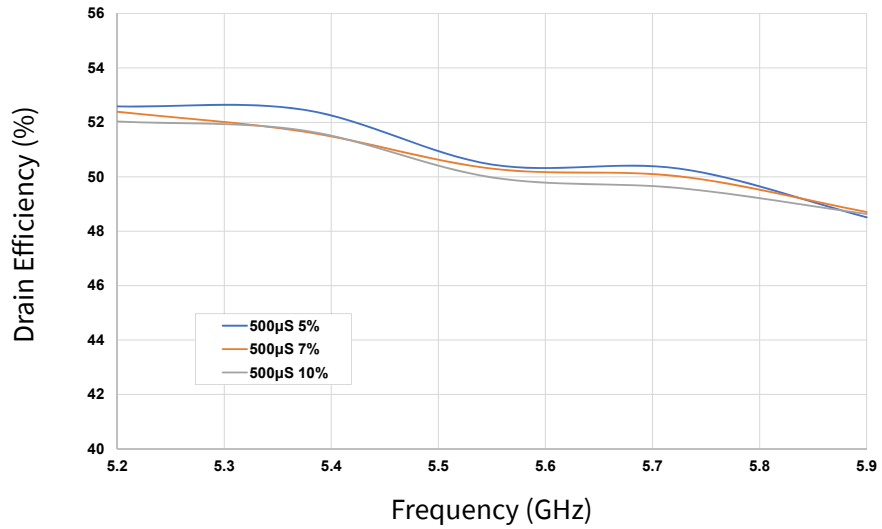
Figure 8. CGHV59350 Gain vs. Frequency
 $V_{DD} = 50\text{ V}$, $P_{IN} = 46\text{ dBm}$, Pulse Width = $500\ \mu\text{s}$, Duty Cycle = 5%, 7%, 10%





Typical Performance

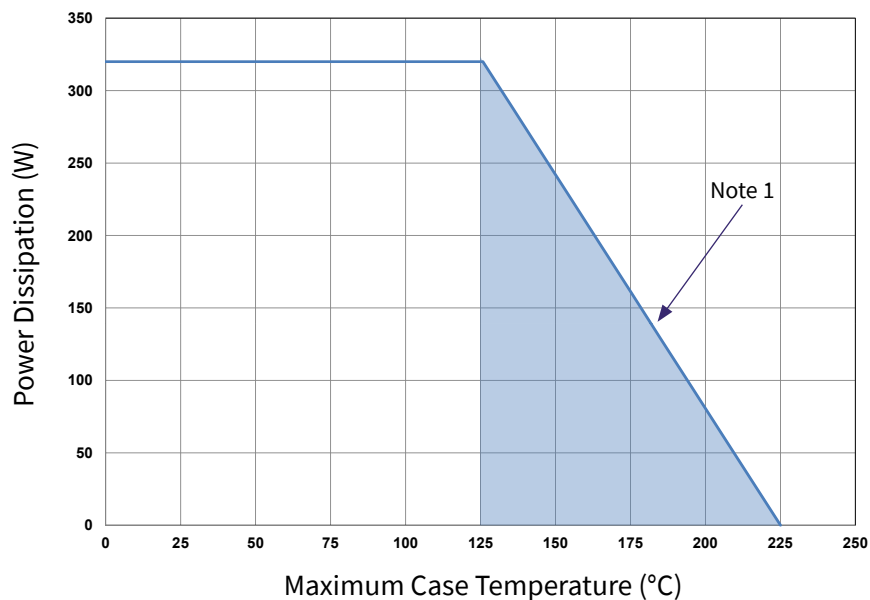
Figure 9. CGHV59350 Drain Efficiency vs. Frequency
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1\text{ A}$, $P_{IN} = 46\text{ dBm}$, Pulse Width = $500\ \mu\text{s}$, Duty Cycle = 5%, 7%, 10%



CGHV59350-AMP Application Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 5.1OHM, +/- 1%, 1/16W,0603	1
R2	RES, 10OHM, +/- 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

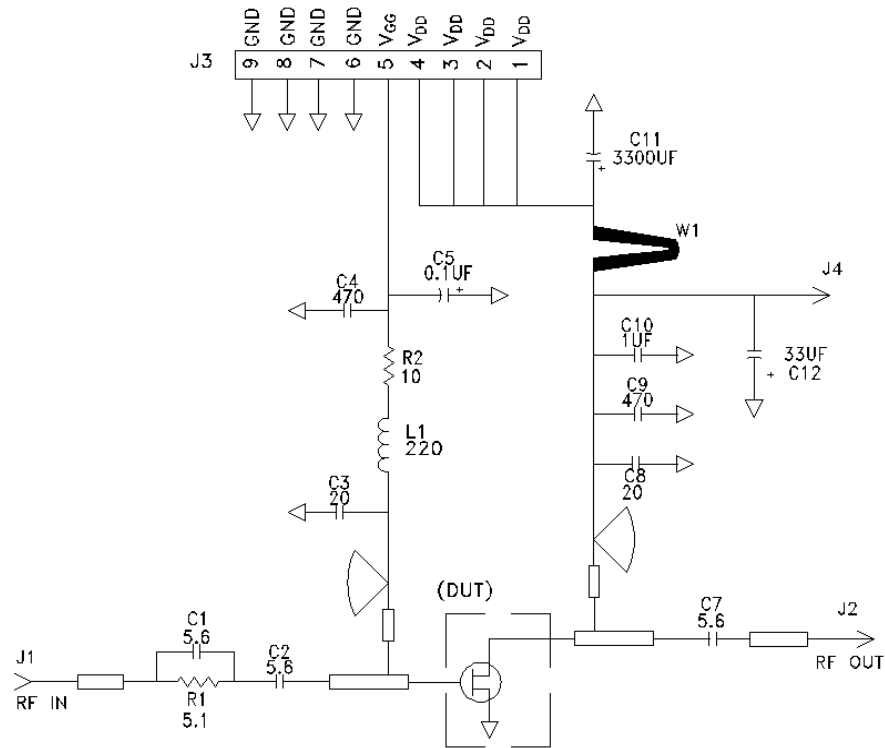
CGHV59350 Power Dissipation De-rating Curve



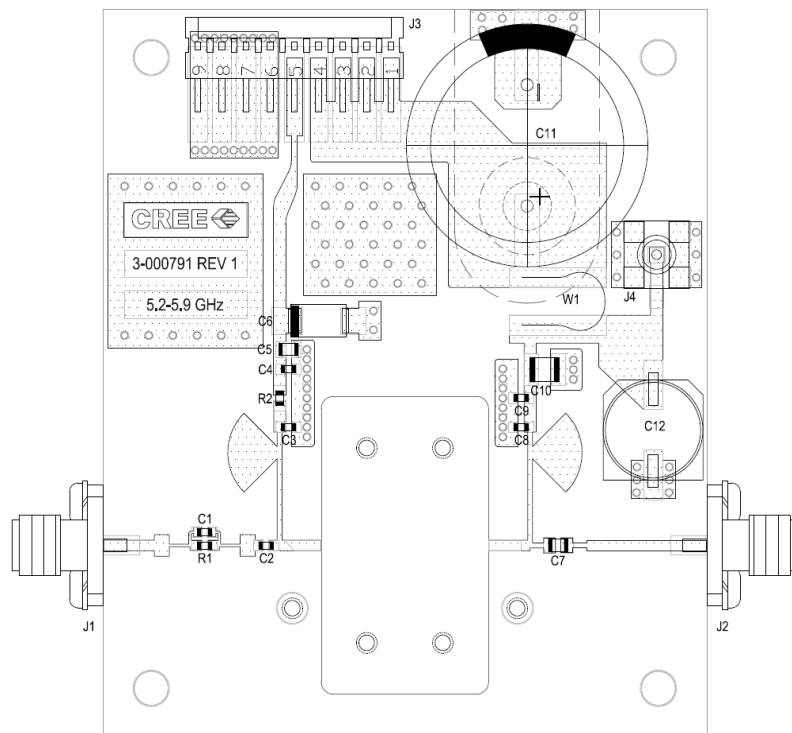
Note 1. Area exceeds Maximum Case Temperature (See Page 2)



CGHV59350-AMP Application Circuit Schematic

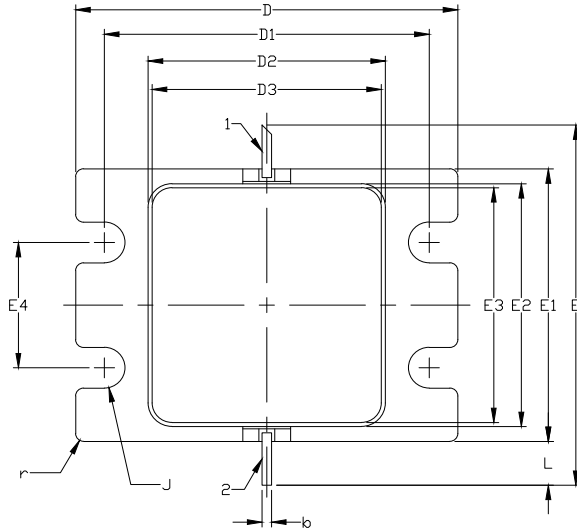


CGHV59350-AMP Application Circuit Outline



Product Dimensions CGHV59350F (Package Type — 440217)

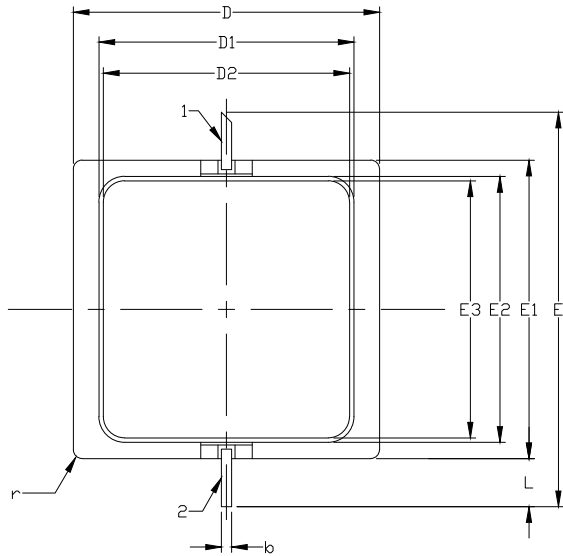
- NOTES: (UNLESS OTHERWISE SPECIFIED)
 1. INTERPRET DRAWING IN ACCORDANCE WITH ANSI Y14.5M-2009
 2. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF .020 BEYOND EDGE OF LID
 3. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF .008 IN ANY DIRECTION
 4. ALL PLATED SURFACES ARE GOLD OVER NICKEL



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

Product Dimensions CGHV59350P (Package Type — 440218)



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	0.698	0.712	17.72	18.08	
D1	0.581	0.593	14.76	15.06	
D2	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	
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

CGHV59350F



Table 1.

Parameter	Value	Units
Upper Frequency ¹	5.9	GHz
Power Output	350	W
Package	F = Flange, P = Pill	-

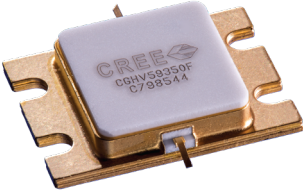

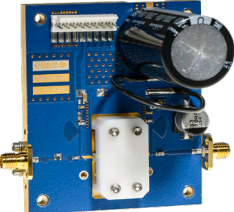
Note¹: Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

Table 2.

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



Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV59350F	GaN HEMT	Each	
CGHV59350P	GaN HEMT	Each	
CGHV59350F-AMP	Test board with GaN HEMT installed	Each	



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RFMarketing@wolfspeed.com

Notes

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