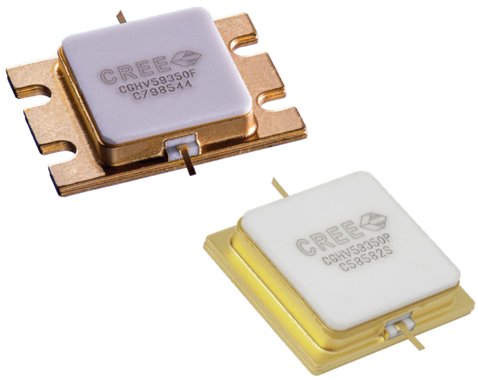
CGHV59350

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˚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 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

Large Signal Models Available for ADS and MWO

RoHS COMPLIANT

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 Characteristics[1] (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 Characteristics[3] (T_C = 25˚C, F_0 = 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 V, I_{DQ} = 1 A, T_{case} = 25 °C

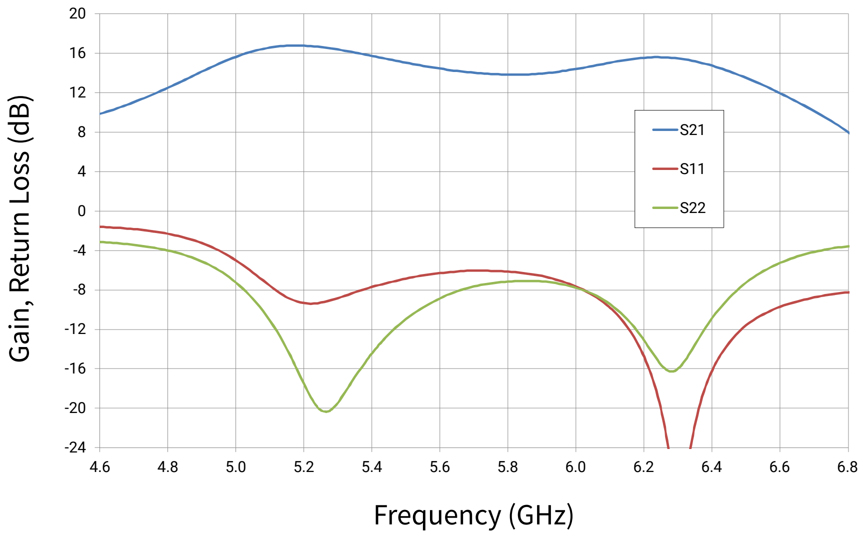
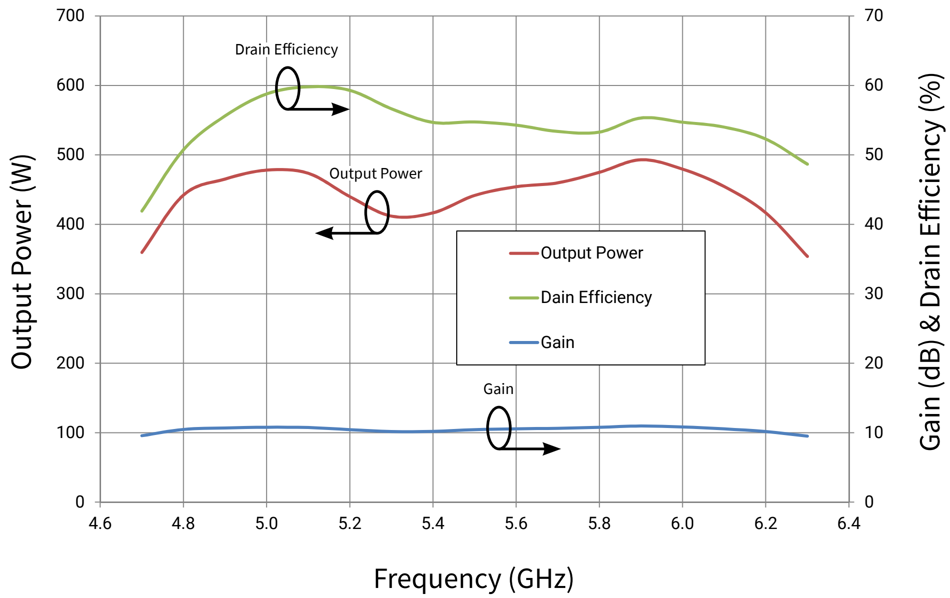


Figure 2. CGHV59350 Output Power, Drain Efficiency, and Gain vs. Frequency at T_{case} = 25 °C
V_{DD} = 50 V, I_{DQ}=1.0 A, P_{IN}= 46 dBm, Pulse Width = 100 µS, Duty Cycle = 10%



Typical Performance

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

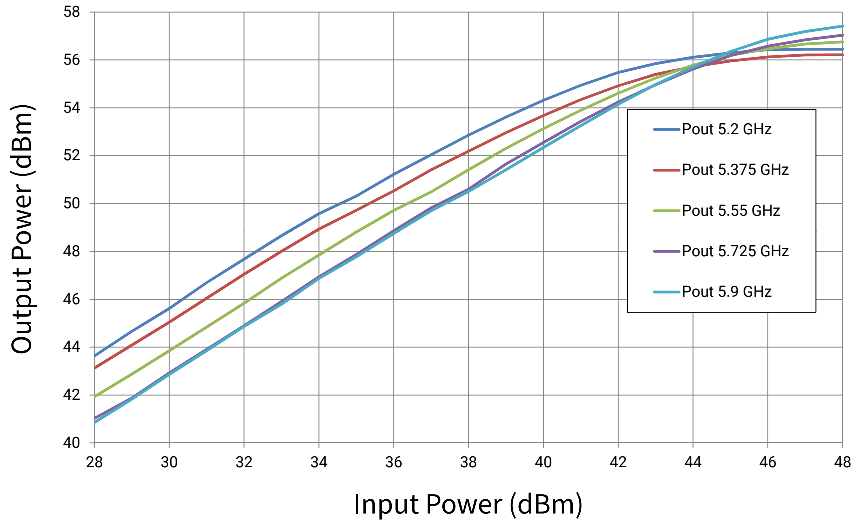
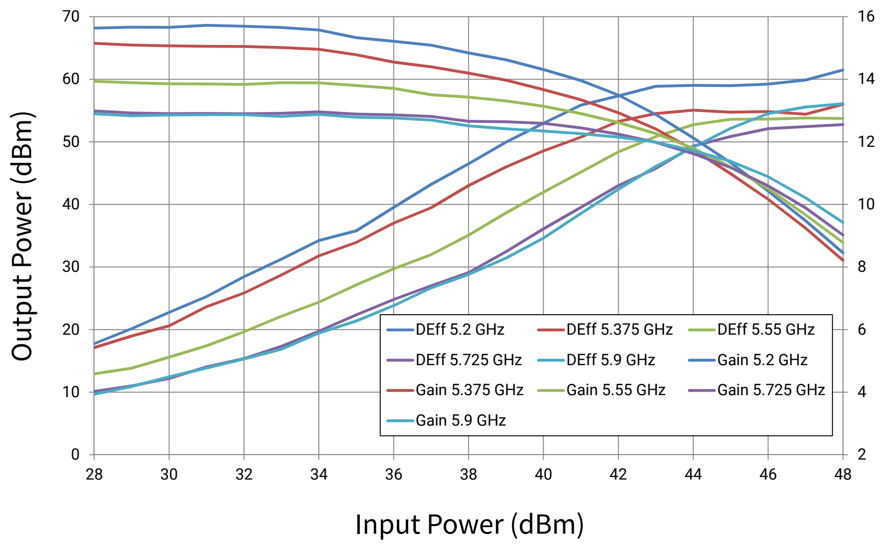


Figure 4. CGHV59350 Output Power vs. Input Power for Gain and Drain Efficiency
V_{DD} = 50 V, I_{DQ} = 1.0 A, Pulse Width = 100 µS, Duty Cycle = 10%, T_{case} = 25 °C



Typical Performance

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

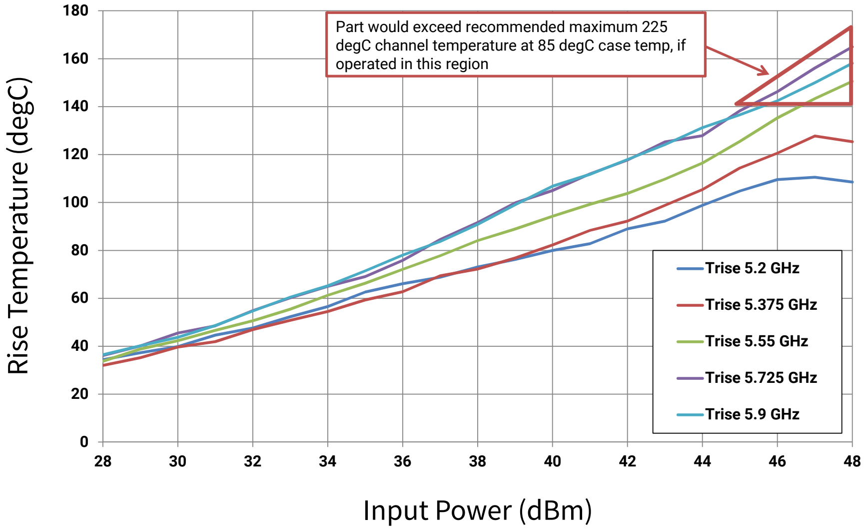
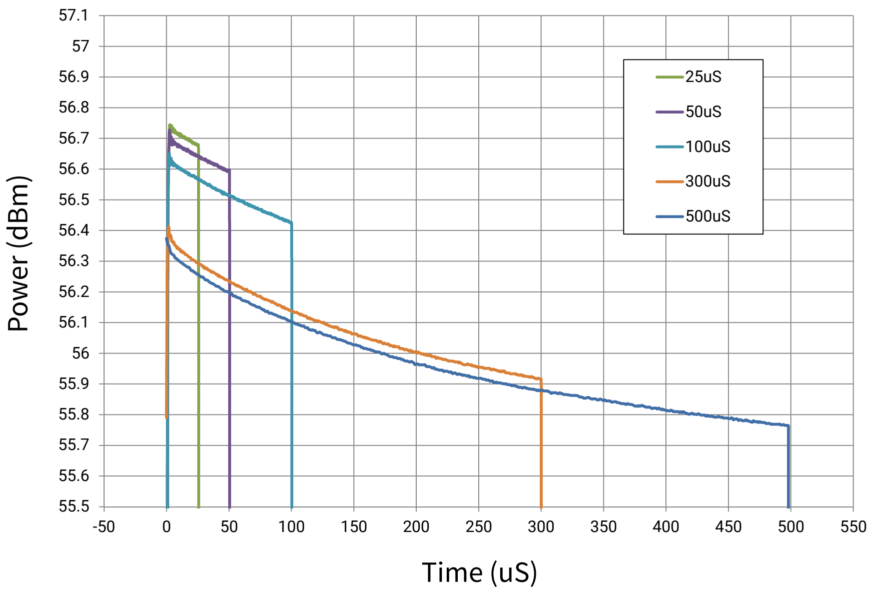


Figure 6. CGHV59350 Output Power vs. Time
V_{DD} = 50 V, P_{IN}=46 dBm, Duty Cycle = 10%



Typical Performance

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

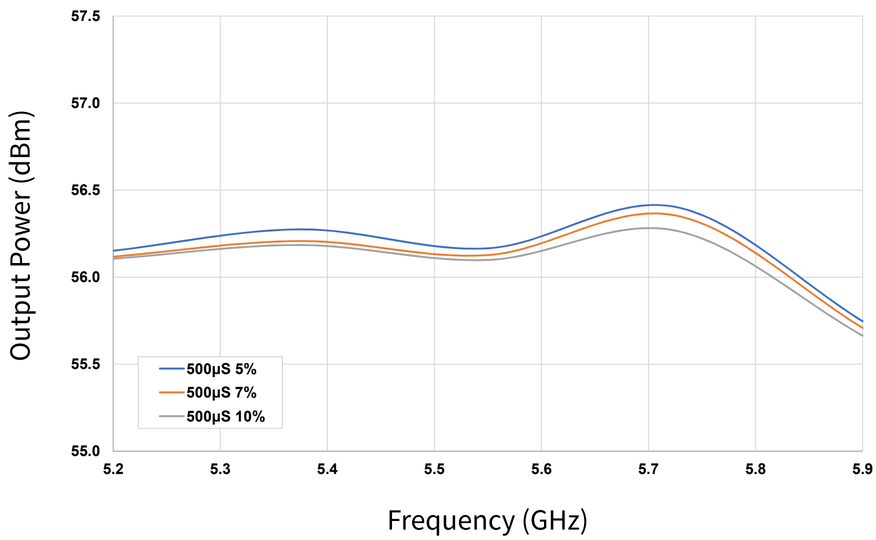
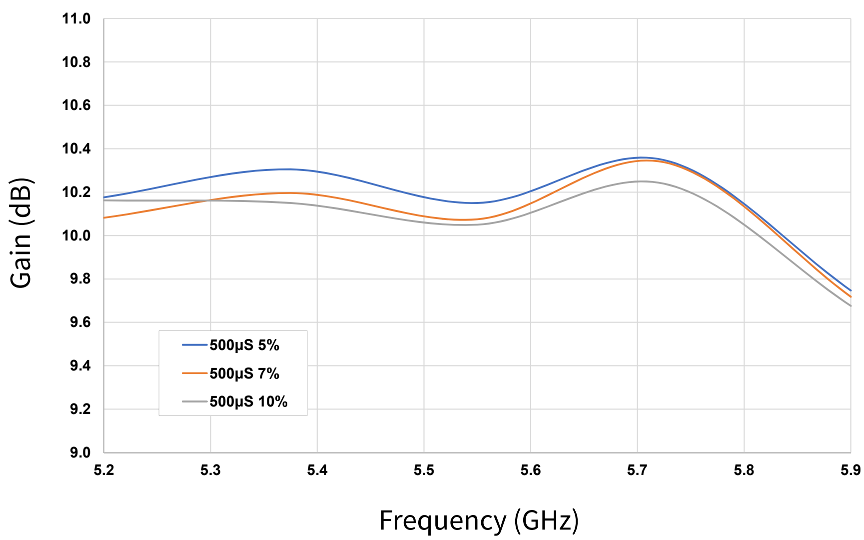
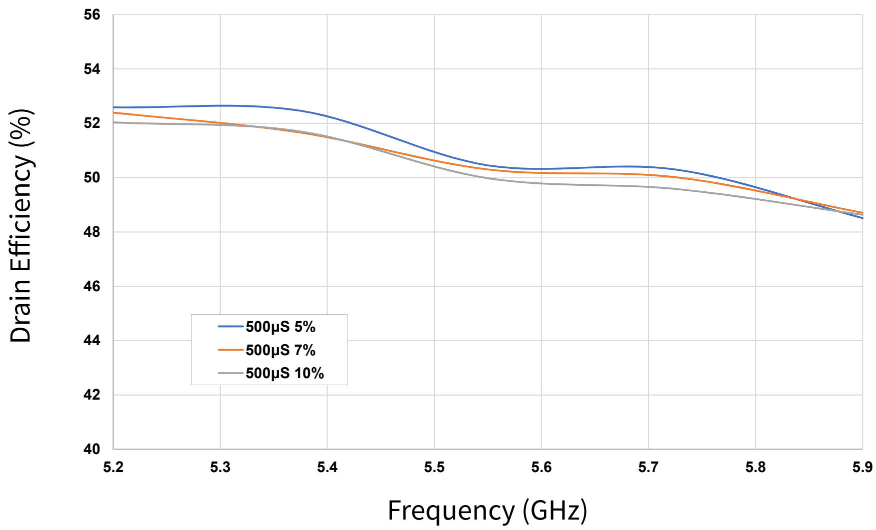


Figure 8. CGHV59350 Gain vs. Frequency
V_{DD} = 50 V, P_{IN}=46 dBm, Pulse Width = 500 µS, Duty Cycle = 5%, 7%, 10%



Typical Performance

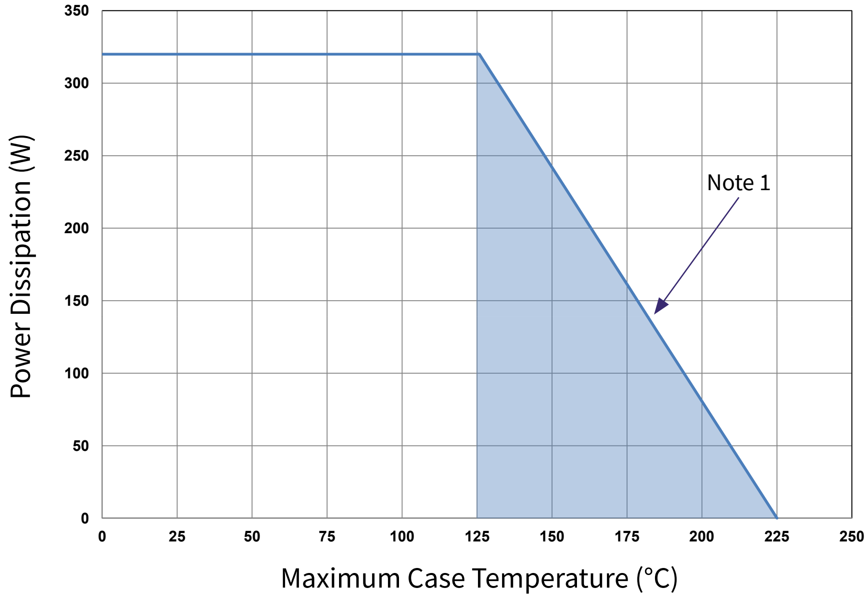
Figure 9. CGHV59350 Drain Efficiency vs. Frequency
V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm, Pulse Width = 500 µS, Duty Cycle = 5%, 7%, 10%



CGHV59350-AMP Application Circuit Bill of Materials

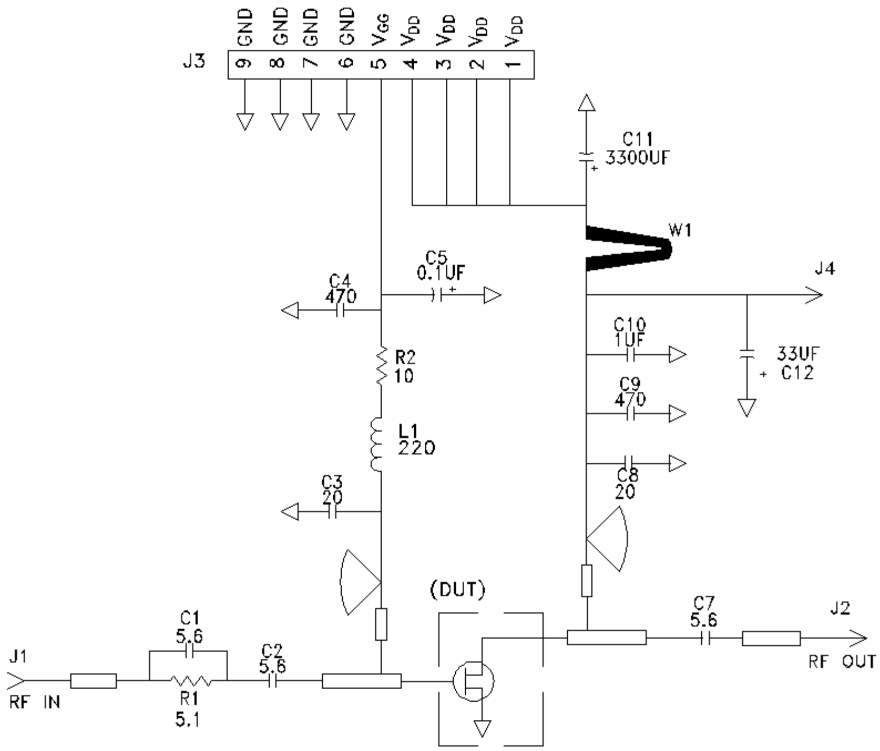
Designator	Description	Qty
R1	RES, 5.1OHM, +/- 1%, 1/16W,0603	1
R2	RES, 10OHM, +/- 1%, 1/16W,0603	1
C1,C2	CAP, 5.6pF, +/- 0.25 pF,250V, 0603	2
C3,C8	CAP, 20pF, +/- 0.25 pF,250V, 0603	2
C4,C9	CAP, 470PF, 5%, 100V, 0603, X	2
C5	CAP, 0.1MF, 1206, 250 V, X7R	1
L1	IND, FERRITE, 220 OHM, 0603	1
C10	CAP, 1.0UF, 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

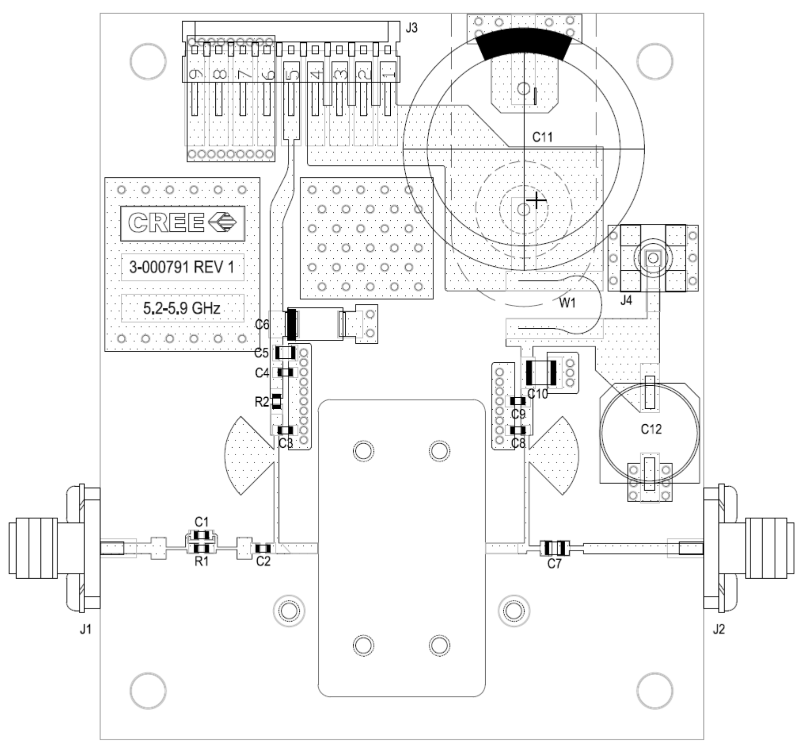


Note 1. Area exceeds Maximum Case Temperature (See Page 2)

CGHV59350-AMP Application Circuit Schematic

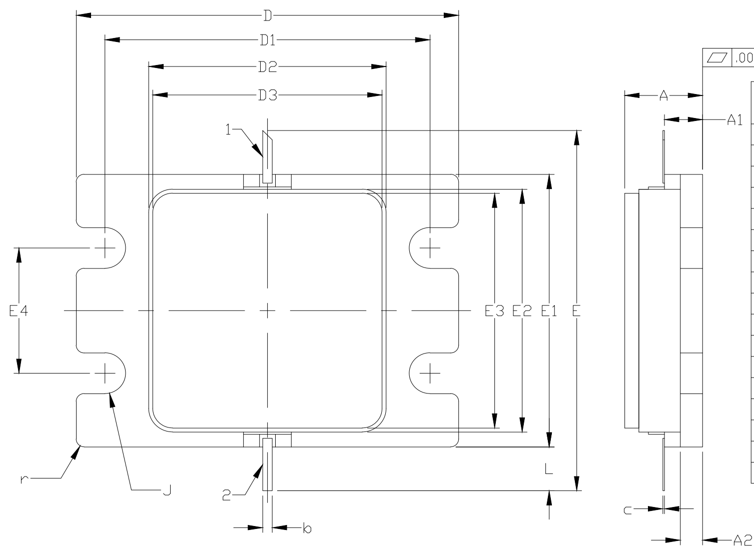


CGHV59350-AMP Application Circuit Outline



Product Dimensions CGHV59350F (Package Type — 440217)

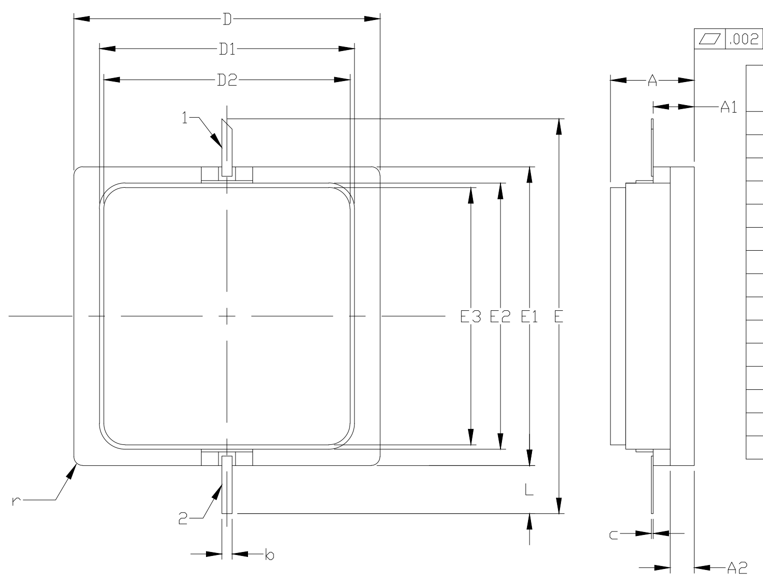
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. INTERPRET DRAWING IN ACCORDANCE WITH ANSI Y14.5M-2009
2. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF .020 BEYOND EDGE OF LID
3. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF .008 IN ANY DIRECTION
4. ALL PLATED SURFACES ARE GOLD OVER NICKEL



1. GATE
2. DRAIN

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX	NOTES
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	ø0.097	ø0.107	ø2.46	ø2.72	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 MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX	NOTES
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	ø0.097	ø0.107	ø2.46	ø2.72	4x
L	0.090	0.130	2.29	3.30	2x
r	0.02 TYP		0.51 TYP		12x

Part Number System

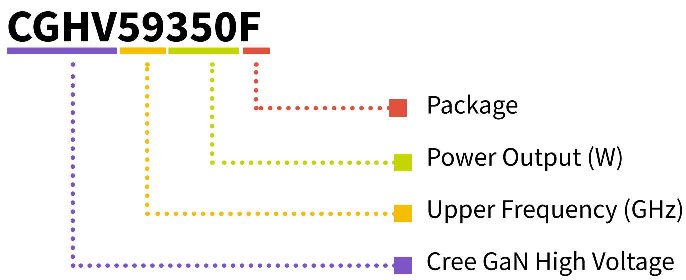


Table 1.

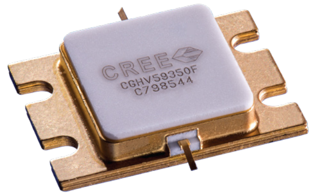
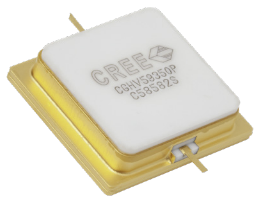
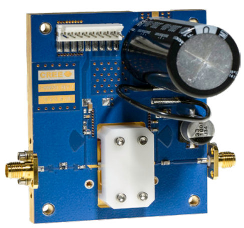
Parameter	Value	Units
Upper Frequency[1]	5.9	GHz
Power Output	350	W
Package	F = Flange, P = Pill	-

Note[1]: 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	

For more information, please contact:

4600 Silicon Drive
Durham, North Carolina, USA 27703
www.wolfspeed.com/RF

Sales Contact
RFSales@wolfspeed.com

RF Product Marketing Contact
RFMarketing@wolfspeed.com

Notes

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.