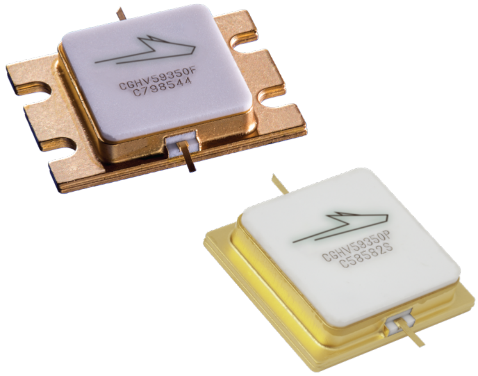
CGHV59350

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

Description

Wolfspeed'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.



PN: CGHV59350F and CGHV59350P
Package Type: 440217 and 440218

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

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	%

Notes:
[1] Measured in the CGHV59350-AMP under 100µs pulse width, 10% duty cycle, P_{IN} = 46 dBm

Large Signal Models Available for ADS and MWO

RoHS compliant

4600 Silicon Drive | Durham, NC 27703 | Tel: +1.919.313.5300

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	V	25°C
Gate-to-Source Voltage	V_{GS}	-10, +2		
Storage Temperature	T_{STG}	-65, +150	°C	
Operating Junction Temperature	T_J	225		
Maximum Forward Gate Current	I_{GMAX}	64	mA	25°C
Maximum Drain Current[1]	I_{DMAX}	24	A	
Soldering Temperature[2]	T_S	245	°C	
Screw Torque	τ	40	in-oz	
Pulsed Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.31	°C/W	100µsec, 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 5 and 9, respectively.

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_{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

4600 Silicon Drive | Durham, NC 27703 | Tel: +1.919.313.5300

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_{OUT}	389	466	-2.3	W	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm
Output Power at 5.4 GHz		335	499	—		
Output Power at 5.8 GHz		302	446	—		
Output Power at 5.9 GHz			468	—		
Gain at 5.2 GHz	G_P	—	10.7	—	dB	
Gain at 5.4 GHz		—	11	—		
Gain at 5.8 GHz		—	10.5	—		
Gain at 5.9 GHz		—	10.7	—		
Drain Efficiency at 5.2 GHz	η	53	68	—	%	
Drain Efficiency at 5.4 GHz		46	67	—		
Drain Efficiency at 5.8 GHz		40	58	—		
Drain Efficiency at 5.9 GHz			59	—		
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		
Output Return Loss	S22	—	-11			
Amplitude Droop	D	—	-0.3	—		V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm
Output Mismatch Stress	VSWR	—	—	5 : 1	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm Pulsed

Notes:
[1] Measured in CGHV59350-AMP. Pulse Width = 100µs, Duty Cycle = 10%

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	TBD	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	TBD	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C

Typical Performance

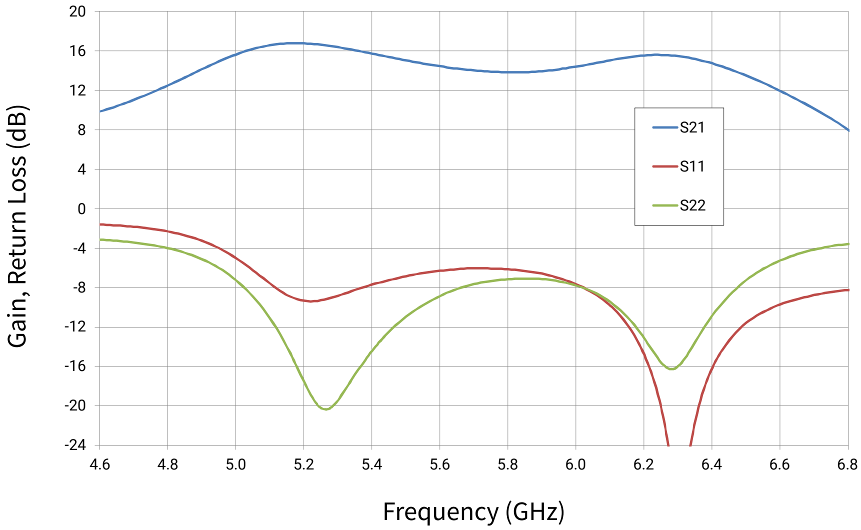


Figure 1. Small Signal S-Parameters for the CGHV59350F in Test Fixture CGHV59350F-TB
V_{DD} = 50 V, I_{DQ} = 1 A, T_{CASE} = 25°C

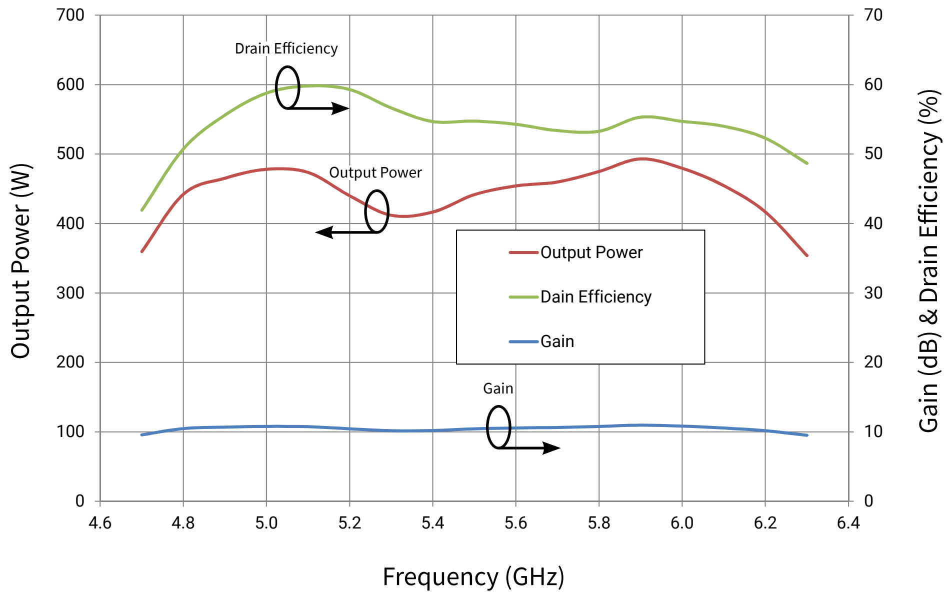


Figure 2. CGHV59350 Output Power, Drain Efficiency, and Gain vs Frequency at T_{CASE} = 25°C
V_{DD} = 50 V, I_{DQ} = 1.0 A, P_{IN} = 46 dBm, Pulse Width = 100μs, Duty Cycle = 10%

Typical Performance

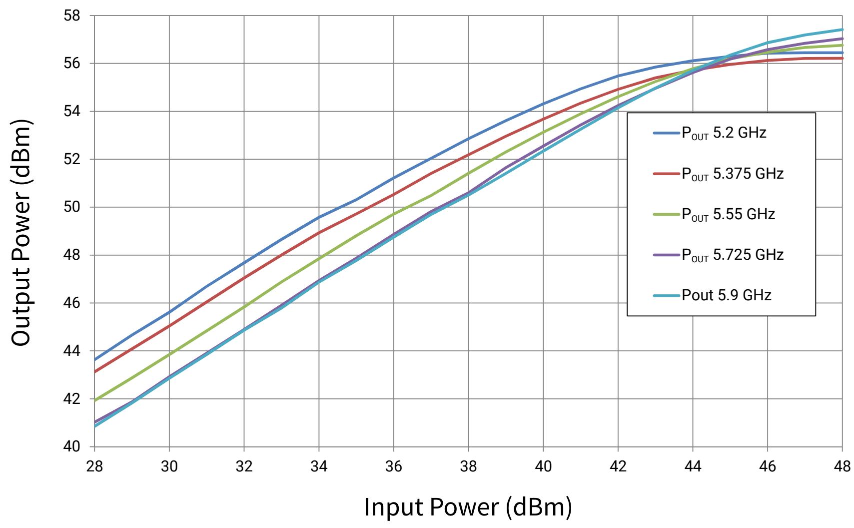


Figure3. CGHV59350 Output Power vs Input Power
V_{DD} = 50 V, I_{DQ} = 1.0 A, Pulse Width = 100µs, Duty Cycle = 10%, T_{CASE} = 25°C

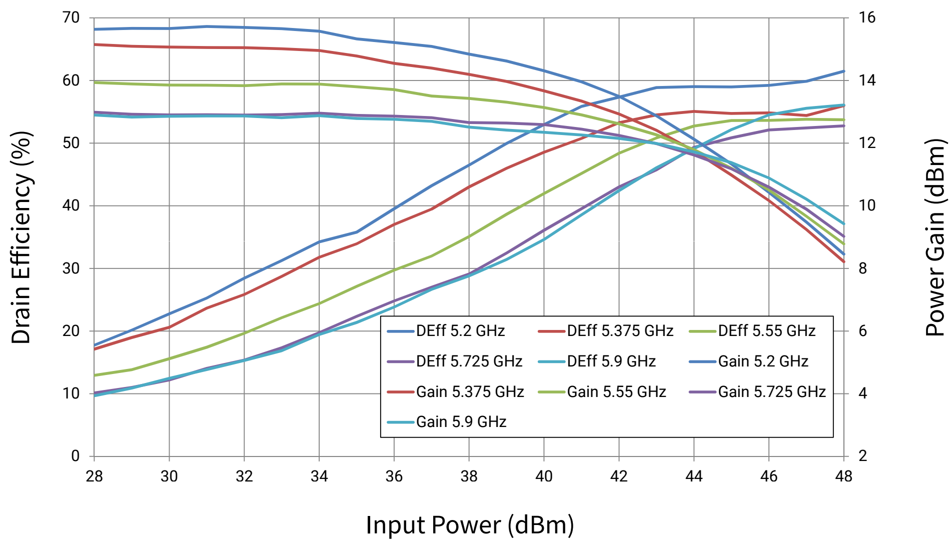


Figure 4. CGHV59350 Drain Efficiency and Gain vs Input Power as a Function of Frequency
V_{DD} = 50 V, I_{DQ} = 1.0 A, Pulse Width = 100µs, Duty Cycle = 10%, T_{CASE} = 25°C

Typical Performance

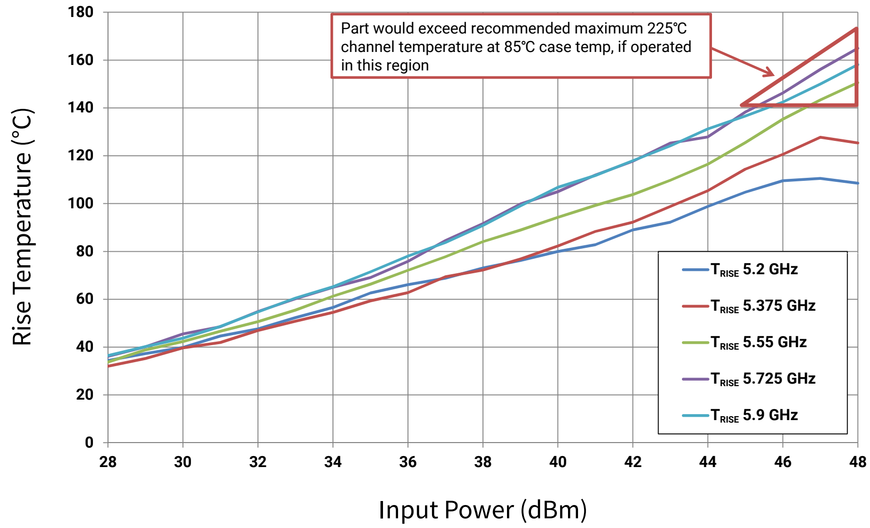


Figure 5. CGHV59350 Rise Temperature vs. Input Power
V_{DD} = 50 V, I_{DQ} = 1 A, Pulse Width = 100µs, Duty Cycle = 10%, T_{CASE} = 25°C

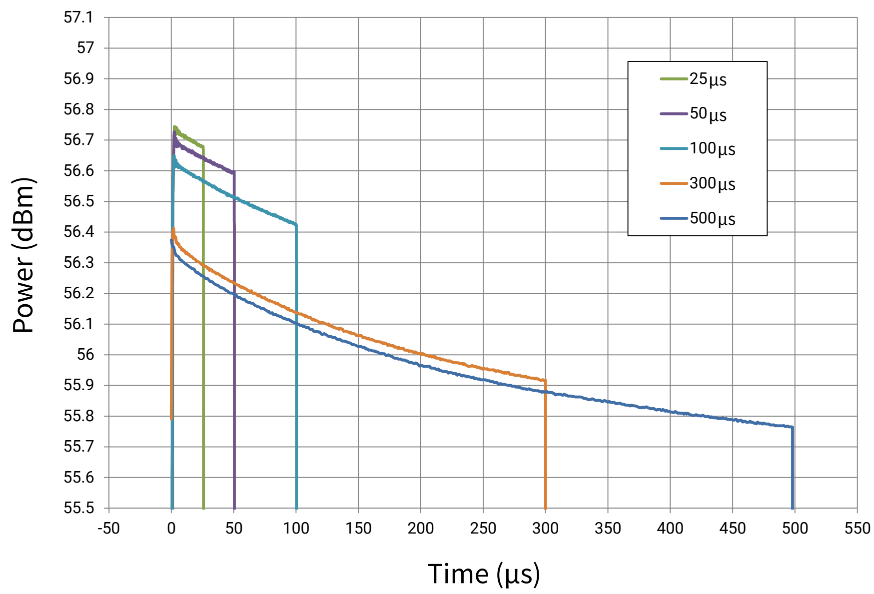


Figure 6. CGHV59350 Output Power vs. Time
V_{DD} = 50 V, P_{IN} = 46 dBm, Duty Cycle = 10%

Typical Performance

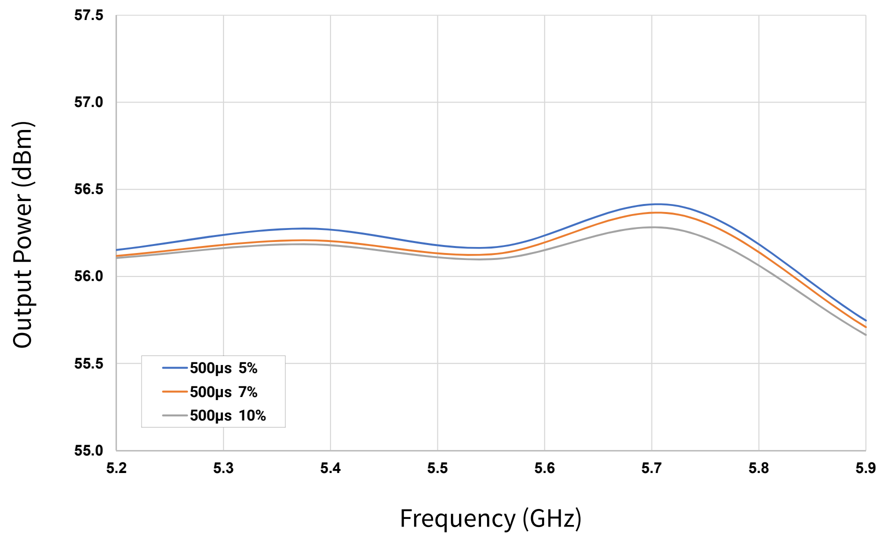


Figure 7. CGHV59350 Output Power vs. Frequency
V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm, Pulse Width = 500µs, Duty Cycle = 5%, 7%, 10%

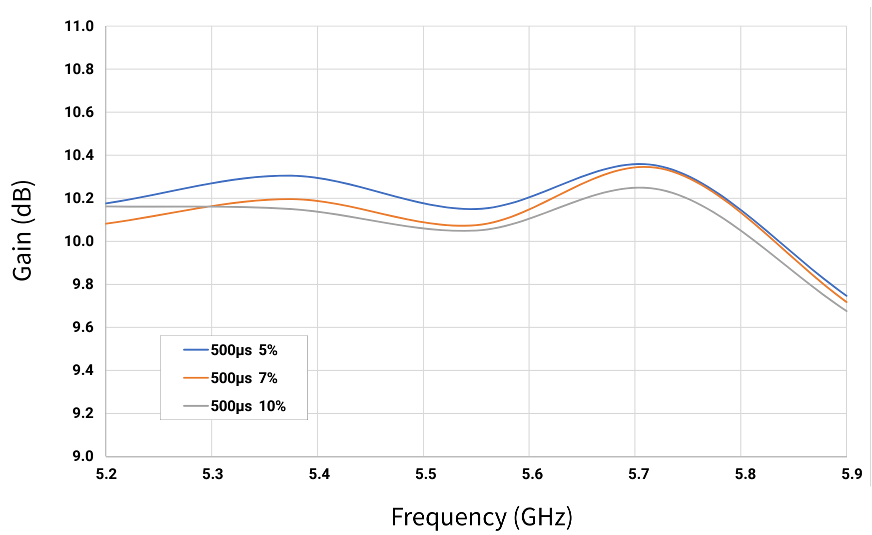


Figure 8. CGHV59350 Gain vs. Frequency
V_{DD} = 50 V, P_{IN} = 46 dBm, Pulse Width = 500µs, Duty Cycle = 5%, 7%, 10%

Typical Performance

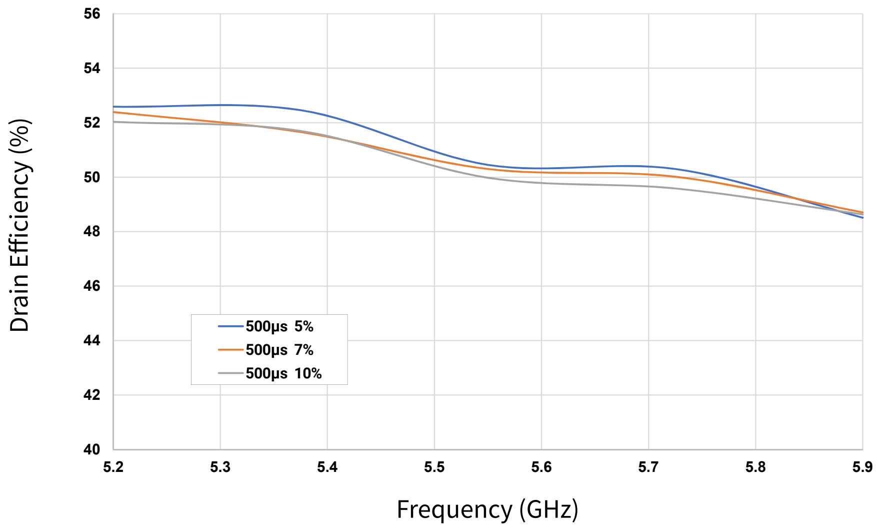


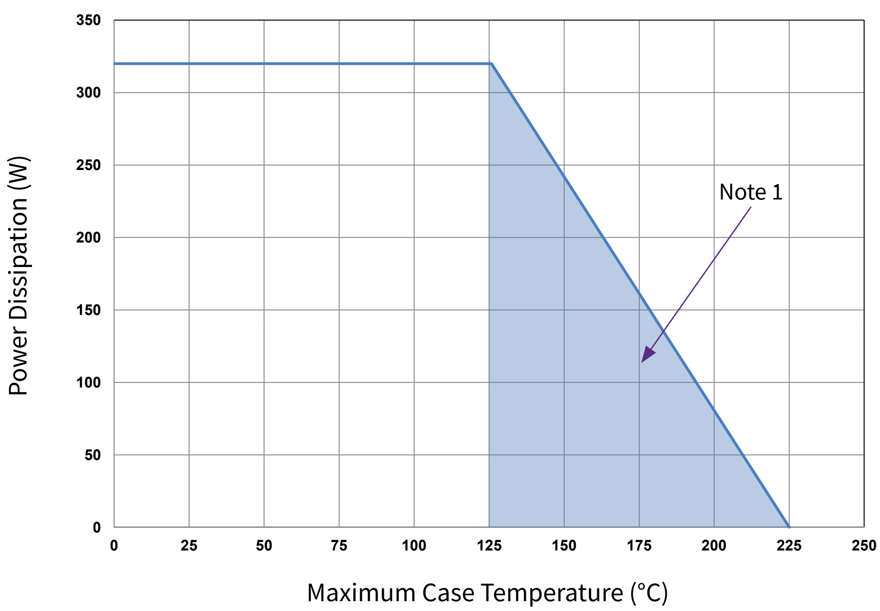
Figure 9. CGHV59350 Drain Efficiency vs. Frequency
V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm, Pulse Width = 500µs, Duty Cycle = 5%, 7%, 10%

4600 Silicon Drive | Durham, NC 27703 | Tel: +1.919.313.5300

CGHV59350-AMP Application Circuit Bill of Materials

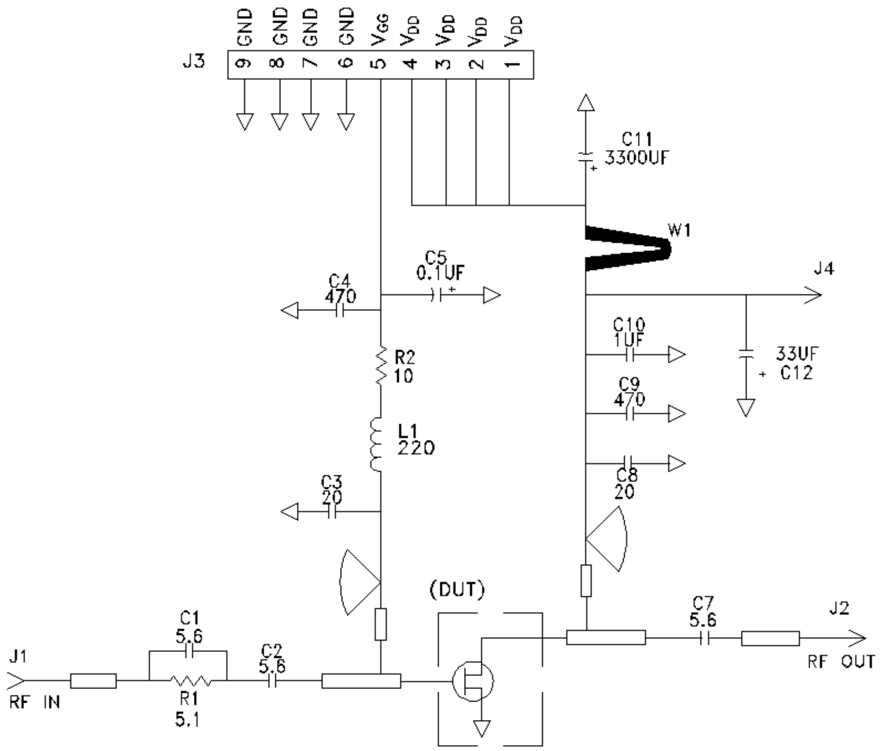
Designator	Description	Qty
R1	RES, 5.1OHM, +/- 1%, 1/16W, 0603	1
R2	RES, 10OHM, +/- 1%, 1/16W, 0603	1
C1, C2	CAP, 5.6pF, +/- 0.25 pF, 250V, 0603	2
C3, C8	CAP, 20pF, +/- 0.25 pF, 250V, 0603	2
C4, C9	CAP, 470pF, 5%, 100V, 0603, X	2
C5	CAP, 0.1µF, 1206, 250 V, X7R	1
L1	IND, FERRITE, 220 OHM, 0603	1
C10	CAP, 1.0µF, 100V, 10%, X7R, 1210	1
C7	CAP, 5.6pF, +/- 0.25 pF, 250V, 0603	1
C11	CAP, 3300µF, +/-20%, 100V, ELECTROLYTIC	1
C12	CAP, 33µF, 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

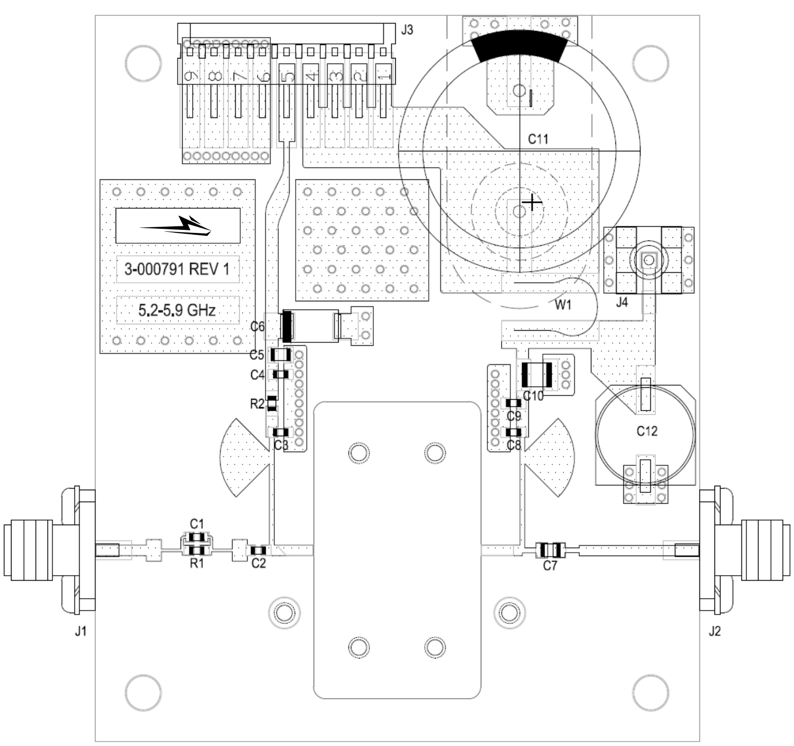


Note
[1] Area exceeds Maximum Case Temperature (See Page 2).

CGHV59350-AMP Application Circuit Schematic

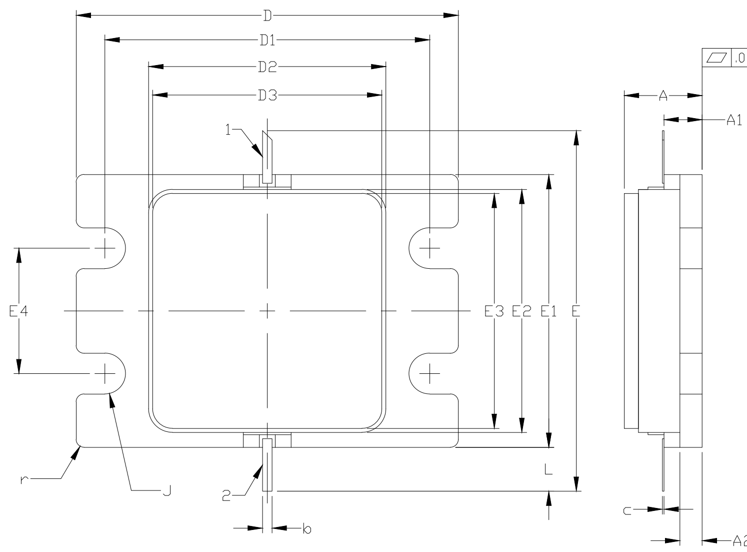


CGHV59350-AMP Application Circuit Outline



Product Dimensions CGHV59350F (Package Type — 440217)

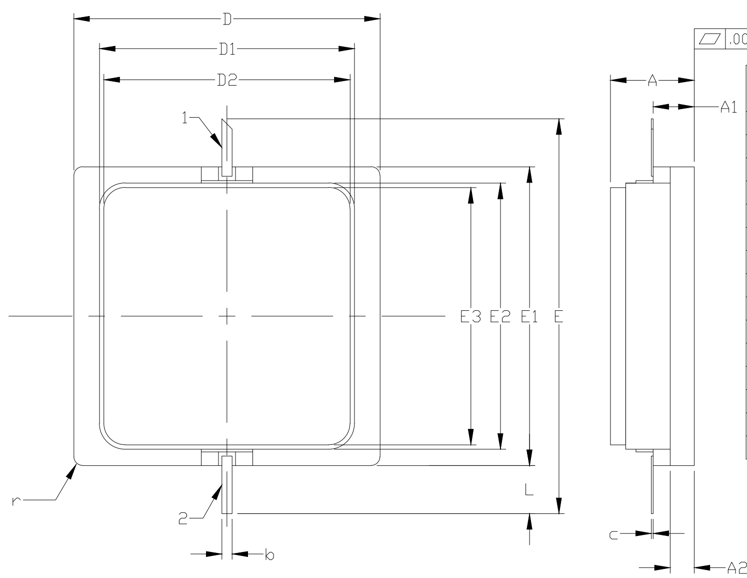
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. INTERPRET DRAWING IN ACCORDANCE WITH ANSI Y14.5M-2009
2. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF .020 BEYOND EDGE OF LID
3. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF .008 IN ANY DIRECTION
4. ALL PLATED SURFACES ARE GOLD OVER NICKEL



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	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		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	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

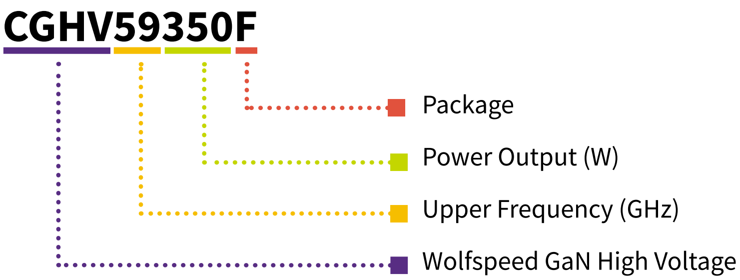


Table 1.

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

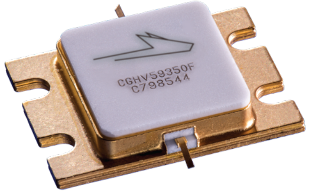
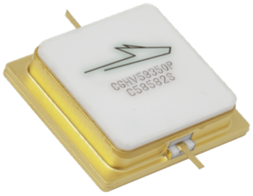
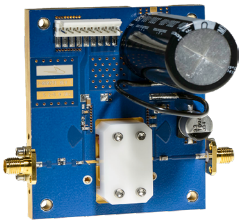
Note:
[1] Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

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

4600 Silicon Drive | Durham, NC 27703 | Tel: +1.919.313.5300

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	

4600 Silicon Drive | Durham, NC 27703 | Tel: +1.919.313.5300

For more information, please contact:

4600 Silicon Drive
Durham, NC 27703 USA
Tel: +1.919.313.5300
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. “Typical” parameters are the average values expected by Wolfspeed in large quantities and are provided for information purposes only. Wolfspeed products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death. No responsibility is assumed by Wolfspeed for any infringement of patents or other rights of third parties which may result from use of the information contained herein. No license is granted by implication or otherwise under any patent or patent rights of Wolfspeed.