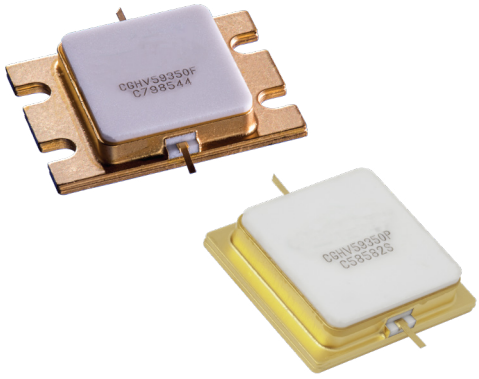
CGHV59350

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

The 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.

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

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
[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

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	—	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	1B, 500V	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D
Charge Device Model	CDM	C2A, 500V	ANSI/ESDA/JEDEC JS-002 Table 3	JEDEC JESD22 C101-C

Typical Performance

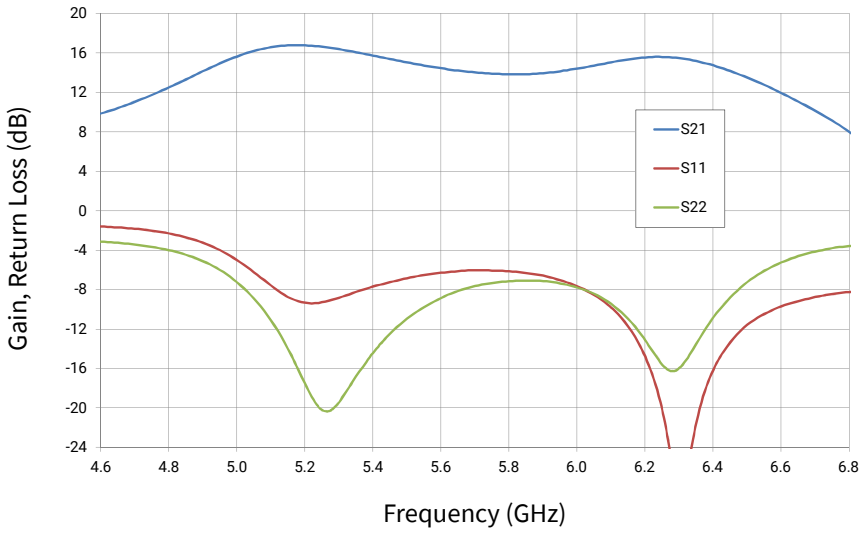


Figure 1. Small Signal S-Parameters for the CGHV59350F in Test Fixture CGHV59350F-TB
V_{DD} = 50 V, I_{DQ} = 1 A, T_{CASE} = 25°C

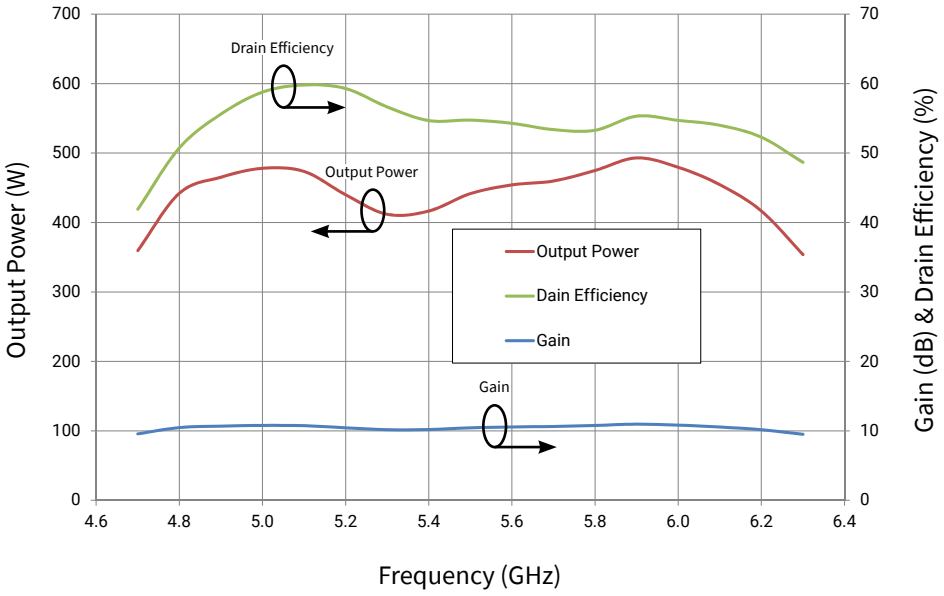


Figure 2. CGHV59350 Output Power, Drain Efficiency, and Gain vs Frequency at T_{CASE} = 25°C
V_{DD} = 50 V, I_{DQ} = 1.0 A, P_{IN} = 46 dBm, Pulse Width = 100µs, Duty Cycle = 10%

Typical Performance

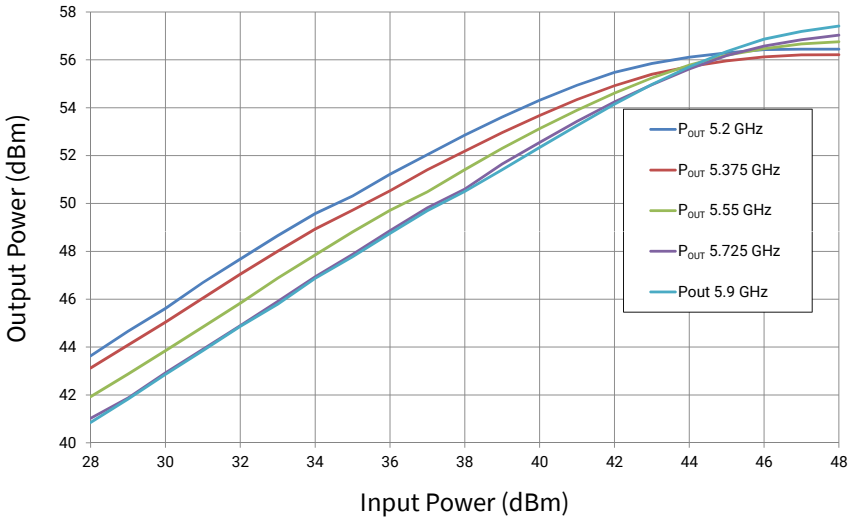


Figure3. CGHV59350 Output Power vs Input Power
V_{DD} = 50 V, I_{DQ} = 1.0 A, Pulse Width = 100µs, Duty Cycle = 10%, T_{CASE} = 25°C

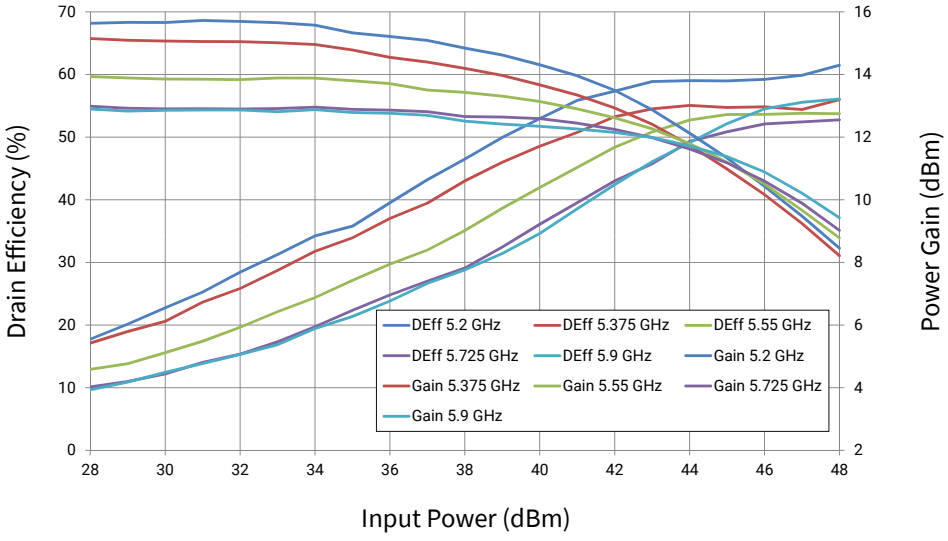


Figure 4. CGHV59350 Drain Efficiency and Gain vs Input Power as a Function of Frequency
V_{DD} = 50 V, I_{DQ} = 1.0 A, Pulse Width = 100µs, Duty Cycle = 10%, T_{CASE} = 25°C

Typical Performance

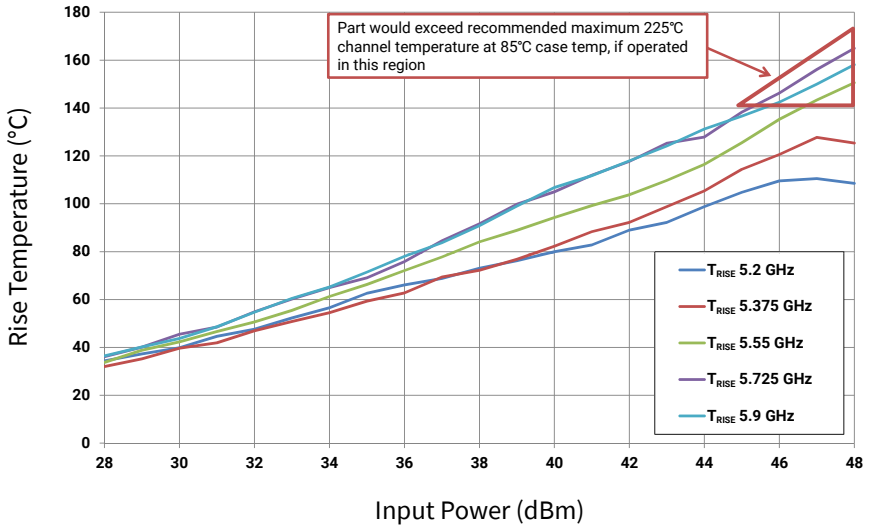


Figure 5. CGHV59350 Rise Temperature vs. Input Power
V_{DD} = 50 V, I_{DQ} = 1 A, Pulse Width = 100µs, Duty Cycle = 10%, T_{CASE} = 25°C

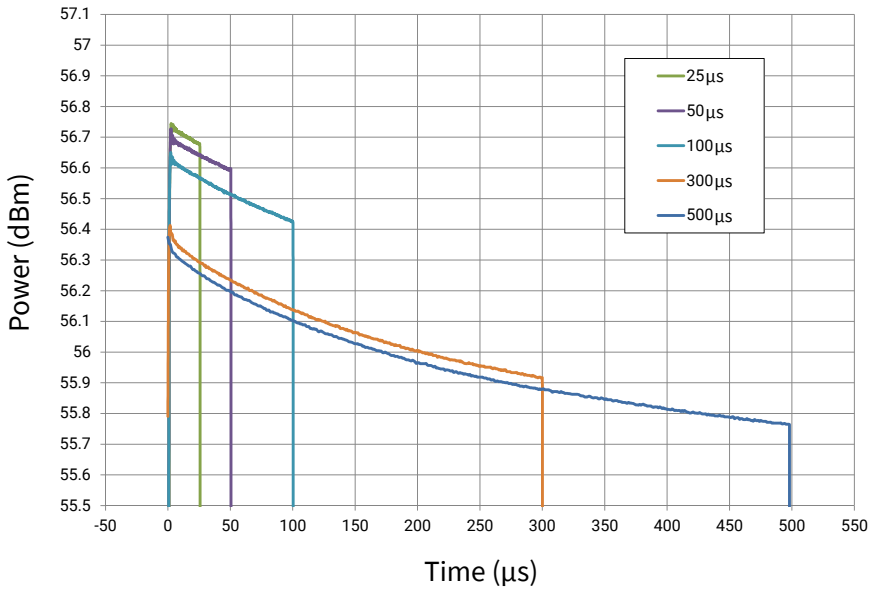


Figure 6. CGHV59350 Output Power vs. Time
V_{DD} = 50 V, P_{IN} = 46 dBm, Duty Cycle = 10%

Typical Performance

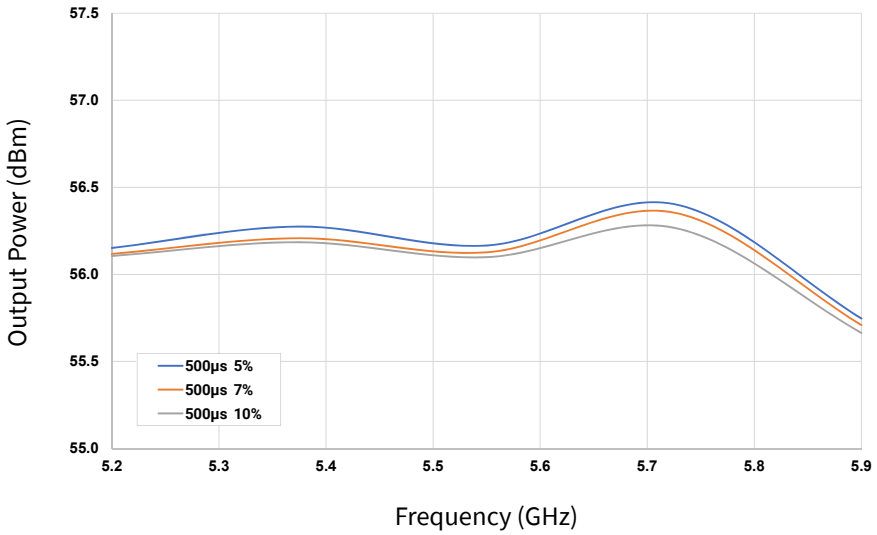


Figure 7. CGHV59350 Output Power vs. Frequency
V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm, Pulse Width = 500µs, Duty Cycle = 5%, 7%, 10%

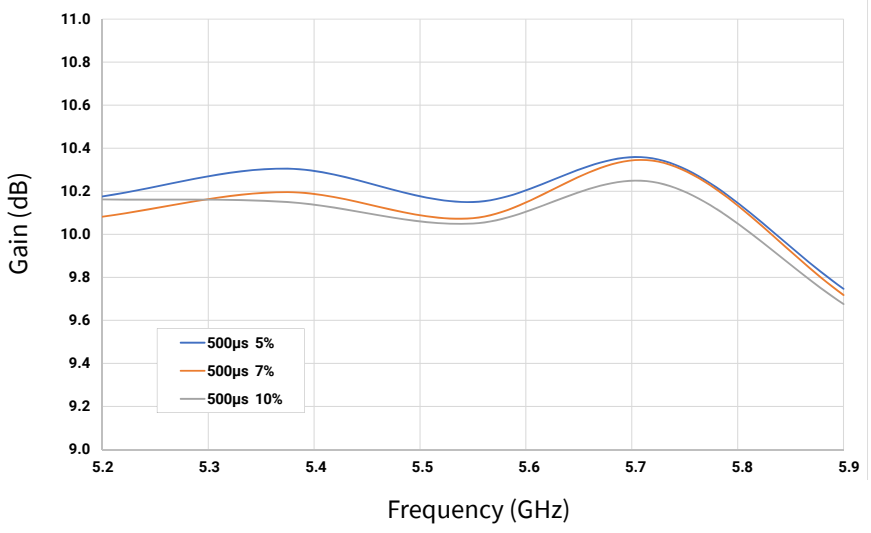


Figure 8. CGHV59350 Gain vs. Frequency
V_{DD} = 50 V, P_{IN} = 46 dBm, Pulse Width = 500µs, Duty Cycle = 5%, 7%, 10%

Typical Performance

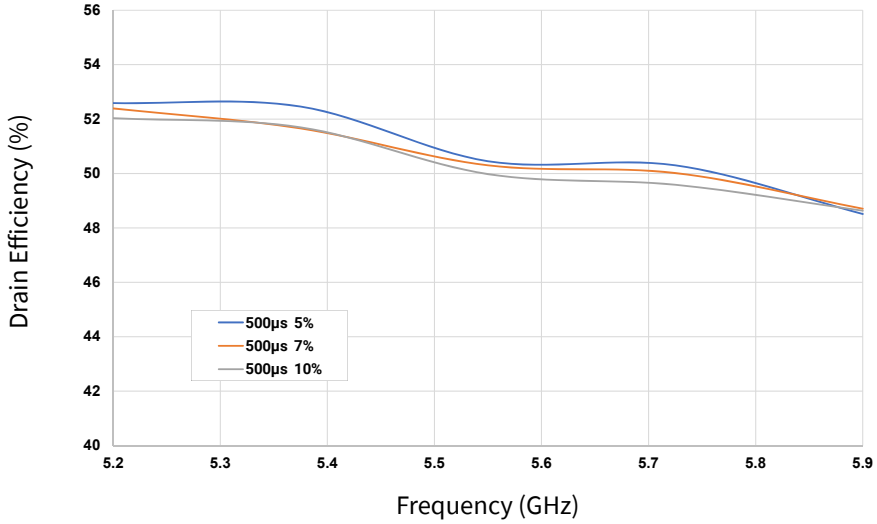
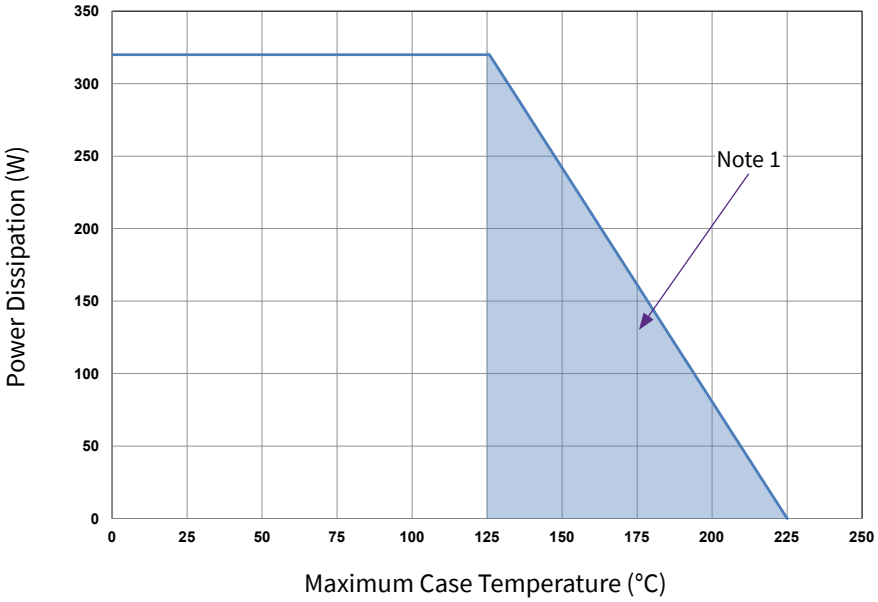


Figure 9. CGHV59350 Drain Efficiency vs. Frequency
V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm, Pulse Width = 500µs, Duty Cycle = 5%, 7%, 10%

CGHV59350-AMP2 Application Circuit Bill of Materials

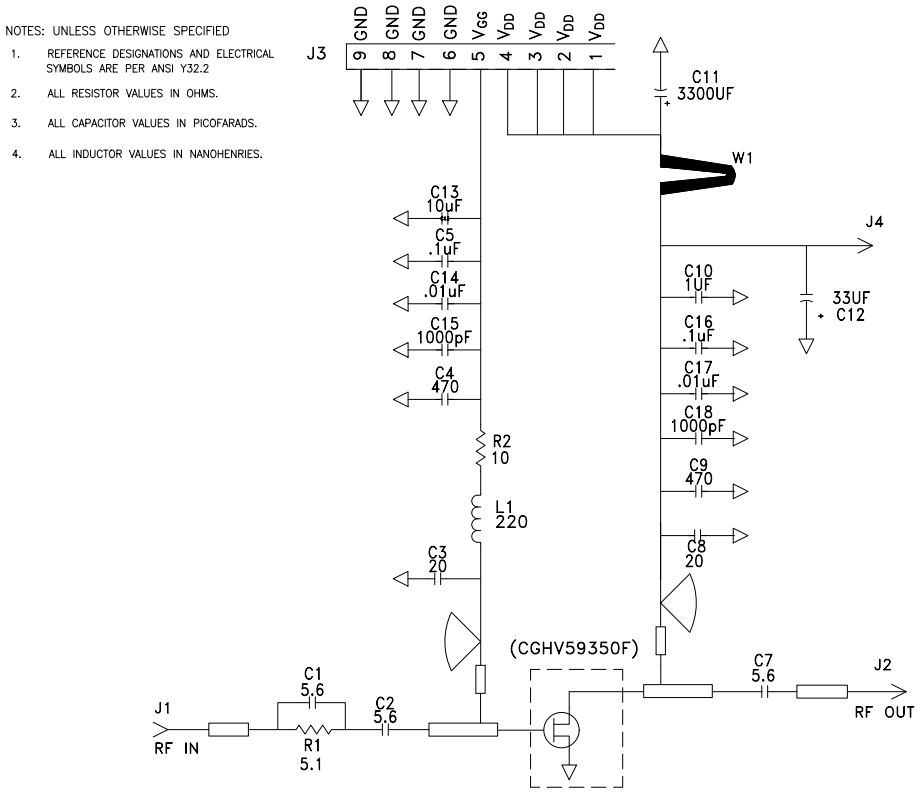
Designator	Description	Qty
R1	RES, 1/16W, 0603, 1%, 5.1 Ohms	1
R2	RES, 1/16W, 0603, 1%, 10.0 Ohms	1
C1, C2	CAP, 5.6pF +/- 0.1pF, 0603	2
C3, C8	CAP, 20.0pF, +/-5%, 0603	2
C4, C9	CAP, 470PF, 5%, 100V, 0603, X7R	2
C5, C16	CAP, 0.1uF, +/-10%, 250V, 1206, X7R	2
L1	IND, FERRITE, 220 OHM, 0603	1
C10	CAP, 1.0µF, 100V, 10%, X7R, 1210	1
C7	CAP, 5.6 PF +/- 0.1 pF, 0805, ATC 600F	1
C11	CAP, 3300µF, +/-20%, 100V, ELECTROLYTIC	1
C12	CAP, 33µF, 20%, G CASE	1
C13	CAP TANT 10UF 10% 16V 2312	1
C14, C17	CAP, 0.01 uF, +/-10%, 250V, 0805, X7R DIELECTRIC	2
C15, C18	CAP, 1000pF, +/-5%, 0603	2
J1, J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST	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

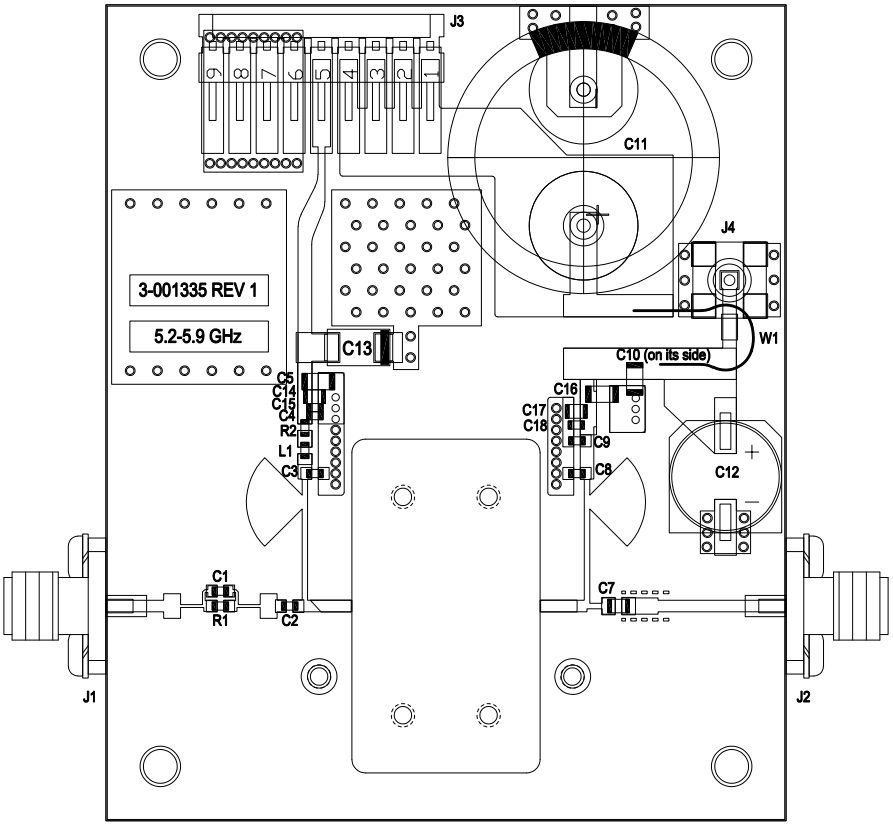


Note
[1] Area exceeds Maximum Case Temperature (See Page 2).

CGHV59350-AMP2 Application Circuit Schematic

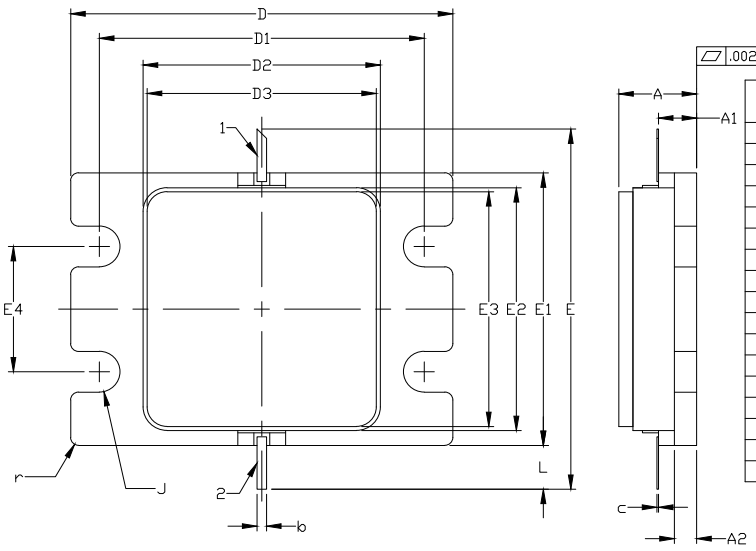


CGHV59350-AMP2 Application Circuit Outline



Product Dimensions CGHV59350F (Package Type — 440217)

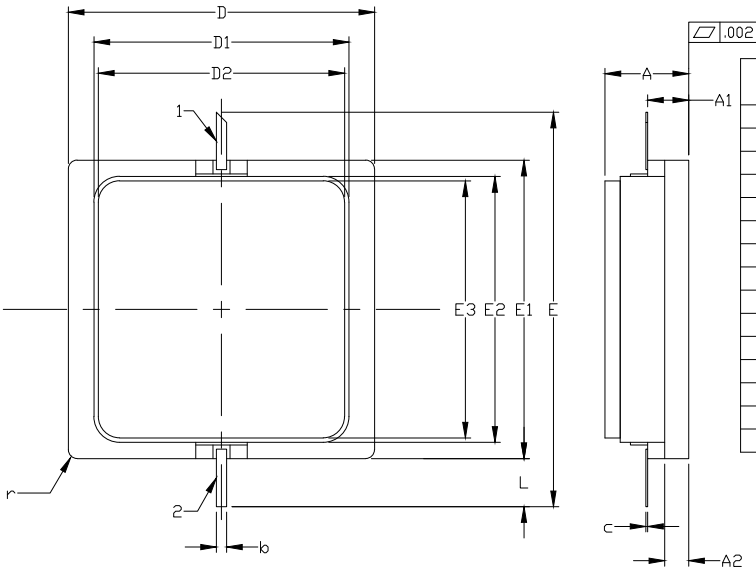
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. INTERPRET DRAWING IN ACCORDANCE WITH ANSI Y14.5M-2009
2. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF .020 BEYOND EDGE OF LID
3. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF .008 IN ANY DIRECTION
4. ALL PLATED SURFACES ARE GOLD OVER NICKEL



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

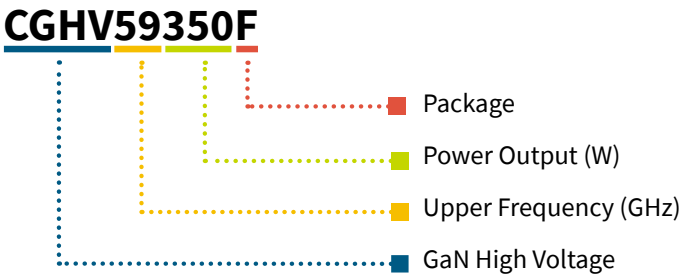


Table 1.

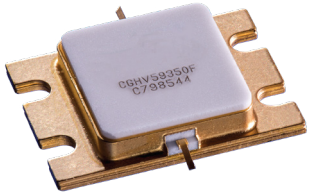
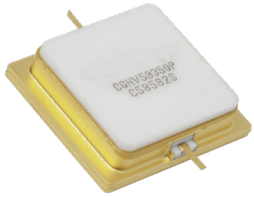
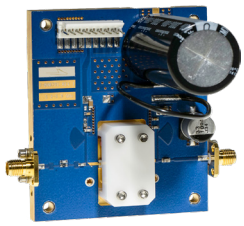
Parameter	Value	Units
Upper Frequency[1]	5.9	GHz
Power Output	350	W
Package	F = Flange, P = Pill	—

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

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV59350F	GaN HEMT	Each	
CGHV59350P	GaN HEMT	Each	
CGHV59350F-AMP2	Test board with GaN HEMT installed	Each	

Notes & Disclaimer

These materials are provided in connection with MACOM’s products as a service to its customers and may be used for informational purposes only. Except as provided in its Terms and Conditions of Sale or any separate agreement, MACOM assumes no liability or responsibility whatsoever, including for (i) errors or omissions in these materials; (ii) failure to update these materials; or (iii) conflicts or incompatibilities arising from future changes to specifications and product descriptions, which MACOM may make at any time, without notice. These materials grant no license, express or implied, to any intellectual property rights.

THESE MATERIALS ARE PROVIDED "AS IS" WITH NO WARRANTY OR LIABILITY, EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHT, ACCURACY OR COMPLETENESS, OR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.