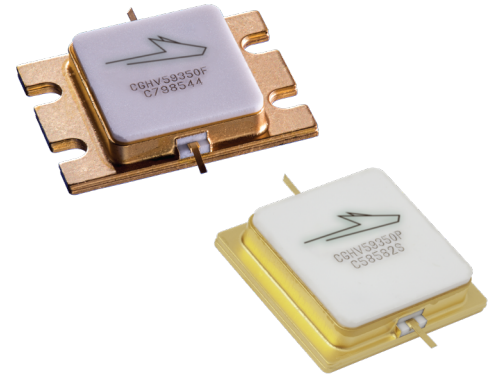


CGHV59350

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 ($T_c = 25^\circ\text{C}$) 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	%

Notes:

¹ Measured in the CGHV59350-AMP under 100 μs pulse width, 10% duty cycle, $P_{IN} = 46 \text{ dBm}$

 Large Signal Models Available for ADS and MWO





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 _{θJC}	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 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 _{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	-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	S ₂₁	11.50	15	—	dB	V _{DD} = 50 V, I _{DQ} = 1 A, P _{IN} = -10 dBm
Input Return Loss	S ₁₁	—	-7	-3		
Output Return Loss	S ₂₂	—	-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 = 100 μs , 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

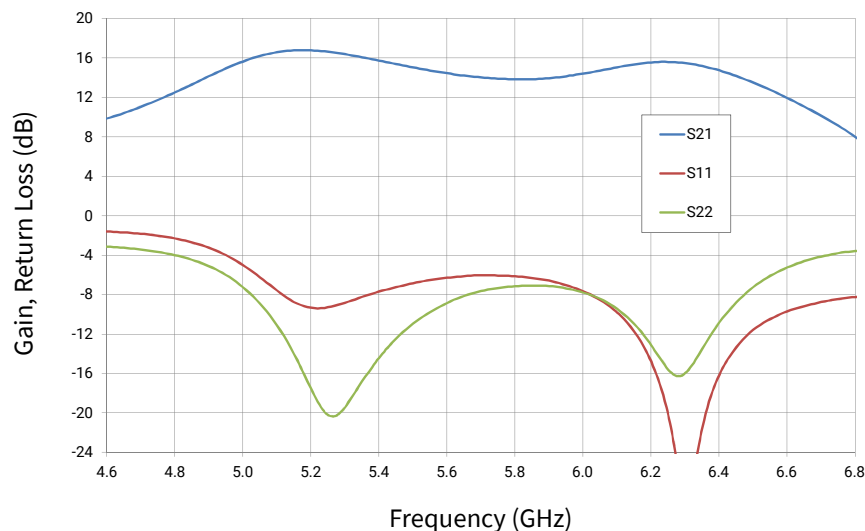


Figure 1. Small Signal S-Parameters for the CGHV59350F in Test Fixture CGHV59350F-TB
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1\text{ A}$, $T_{CASE} = 25^{\circ}\text{C}$

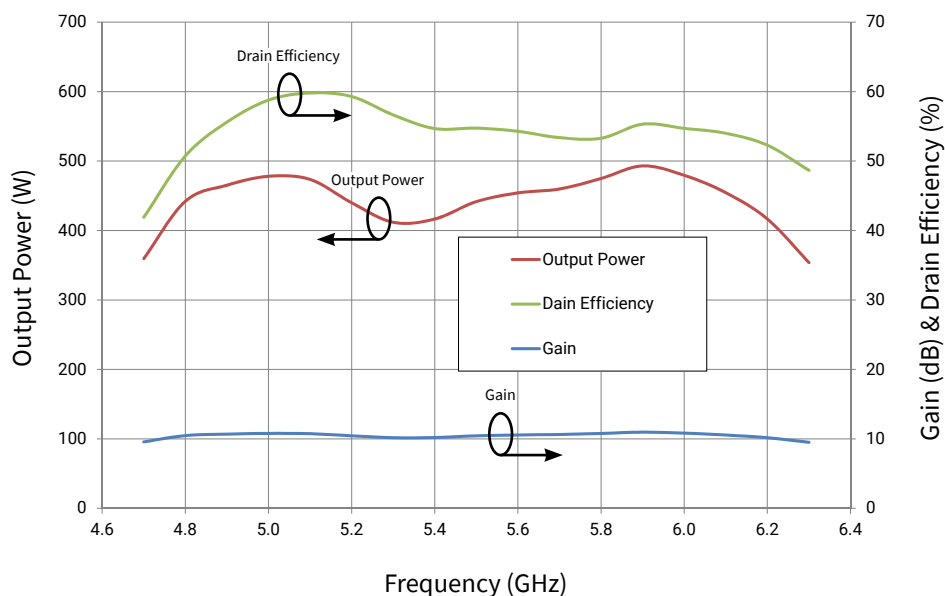


Figure 2. CGHV59350 Output Power, Drain Efficiency, and Gain vs Frequency at $T_{CASE} = 25^{\circ}\text{C}$
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$, $P_{IN} = 46\text{ dBm}$, Pulse Width = $100\mu\text{s}$, Duty Cycle = 10%

Typical Performance

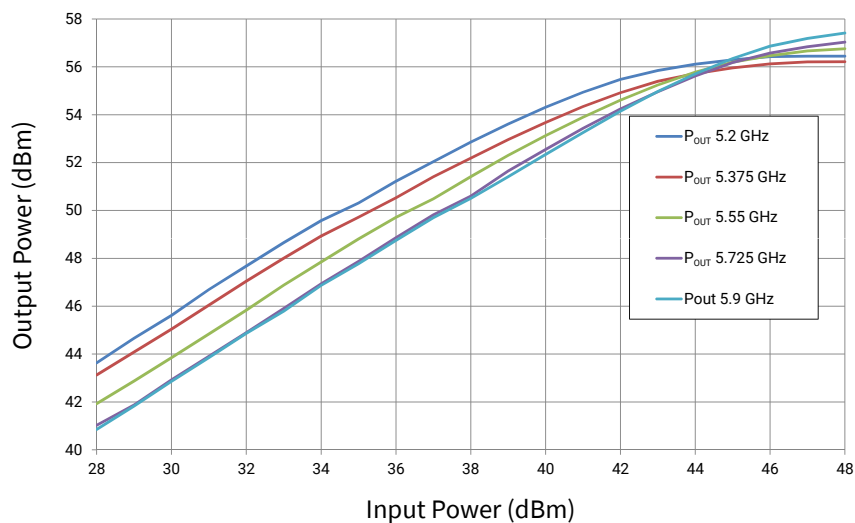


Figure 3. CGHV59350 Output Power vs Input Power
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$, Pulse Width = 100 μs , Duty Cycle = 10%, $T_{CASE} = 25^\circ\text{C}$

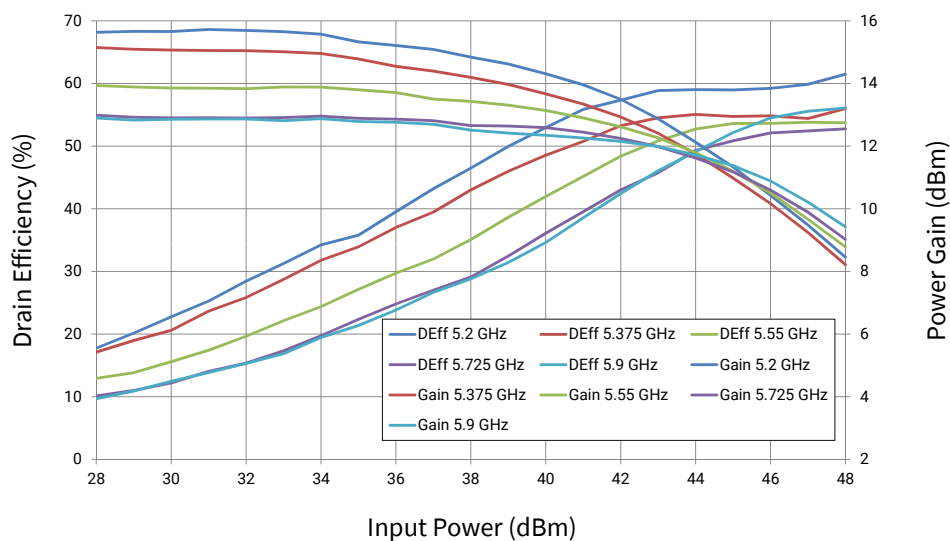


Figure 4. CGHV59350 Drain Efficiency and Gain vs Input Power as a Function of Frequency
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1.0\text{ A}$, Pulse Width = 100 μs , Duty Cycle = 10%, $T_{CASE} = 25^\circ\text{C}$

Typical Performance

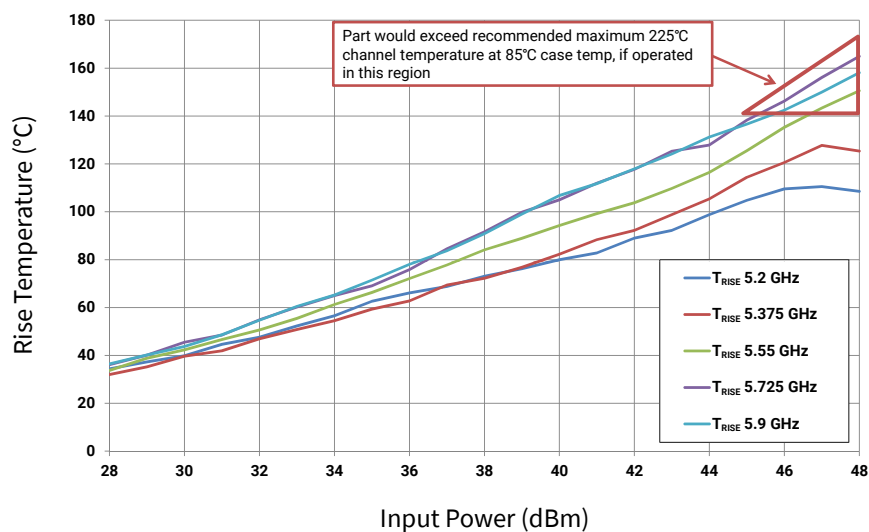


Figure 5. CGHV59350 Rise Temperature vs. Input Power
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1\text{ A}$, Pulse Width = $100\mu\text{s}$, Duty Cycle = 10%, $T_{CASE} = 25^\circ\text{C}$

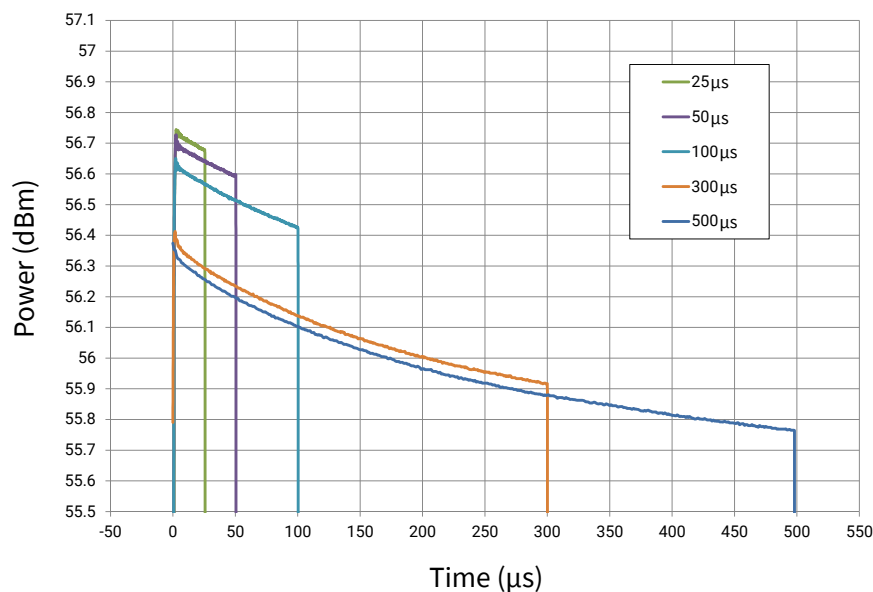


Figure 6. CGHV59350 Output Power vs. Time
 $V_{DD} = 50\text{ V}$, $P_{IN} = 46\text{ dBm}$, Duty Cycle = 10%



Typical Performance

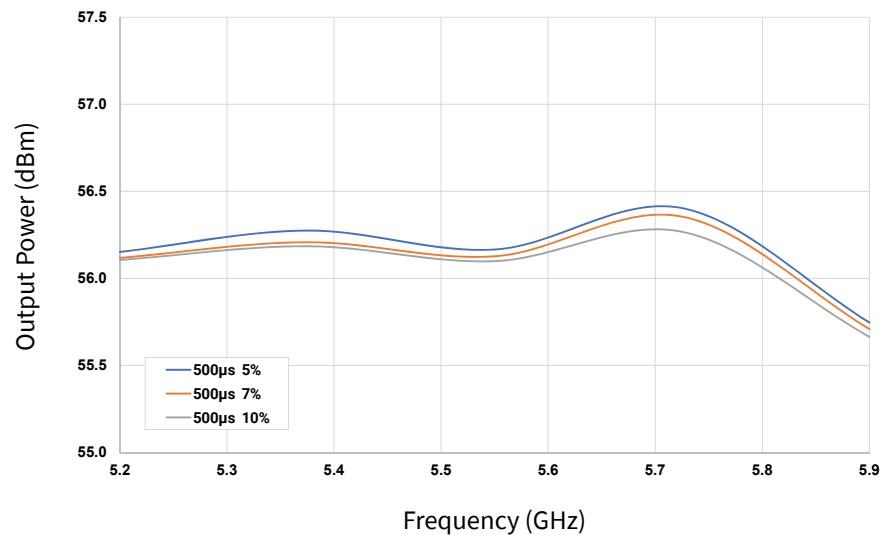


Figure 7. CGHV59350 Output Power vs. Frequency
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1\text{ A}$, $P_{IN} = 46\text{ dBm}$, Pulse Width = $500\mu\text{s}$, Duty Cycle = 5%, 7%, 10%

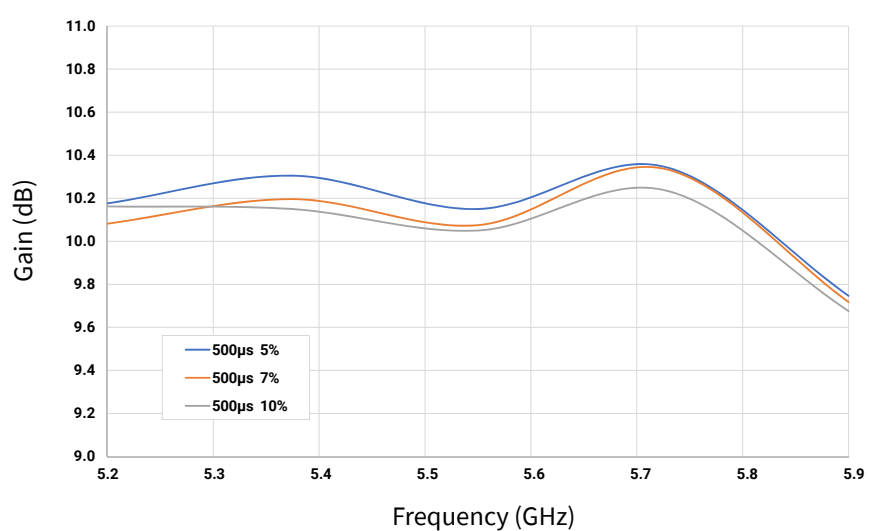


Figure 8. CGHV59350 Gain vs. Frequency
 $V_{DD} = 50\text{ V}$, $P_{IN} = 46\text{ dBm}$, Pulse Width = $500\mu\text{s}$, Duty Cycle = 5%, 7%, 10%

Typical Performance

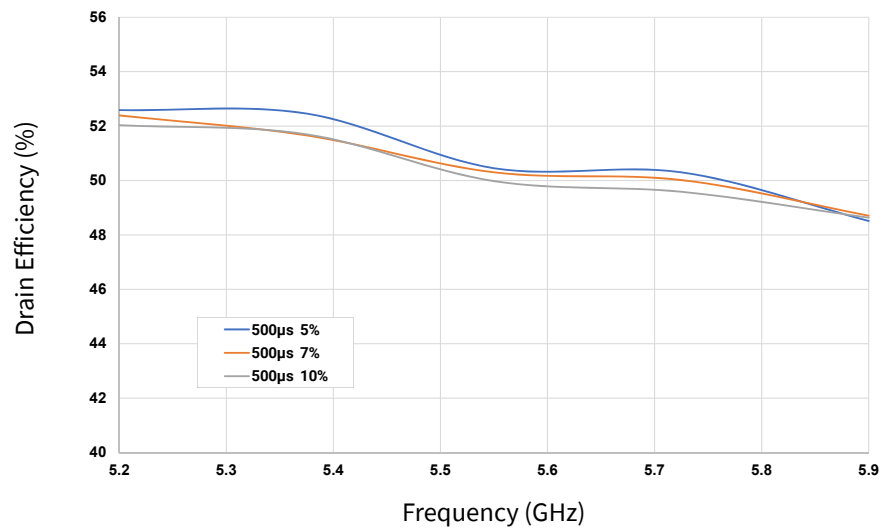


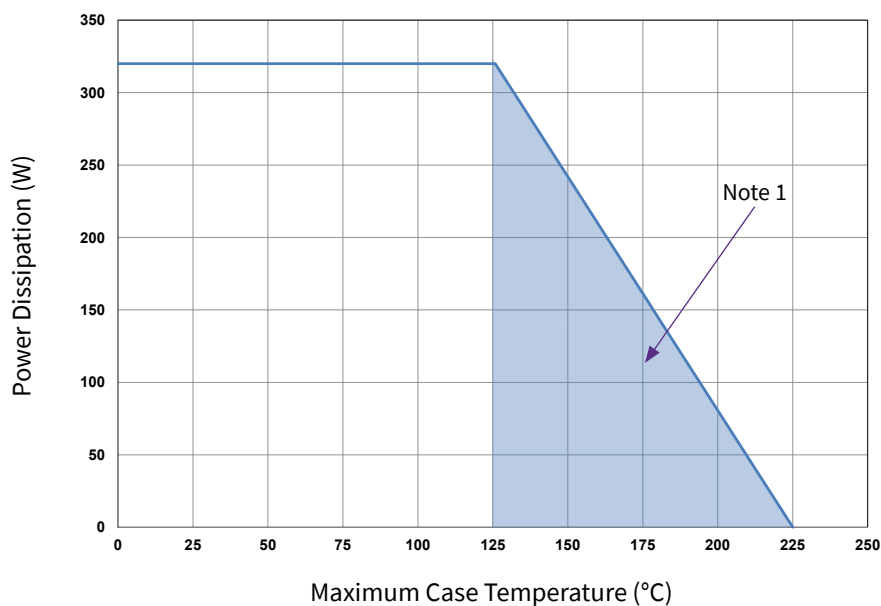
Figure 9. CGHV59350 Drain Efficiency vs. Frequency
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 1\text{ A}$, $P_{IN} = 46\text{ dBm}$, Pulse Width = $500\mu\text{s}$, Duty Cycle = 5%, 7%, 10%



CGHV59350-AMP Application Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 5.1OHM, +/- 1%, 1/16W, 0603	1
R2	RES, 100OHM, +/- 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

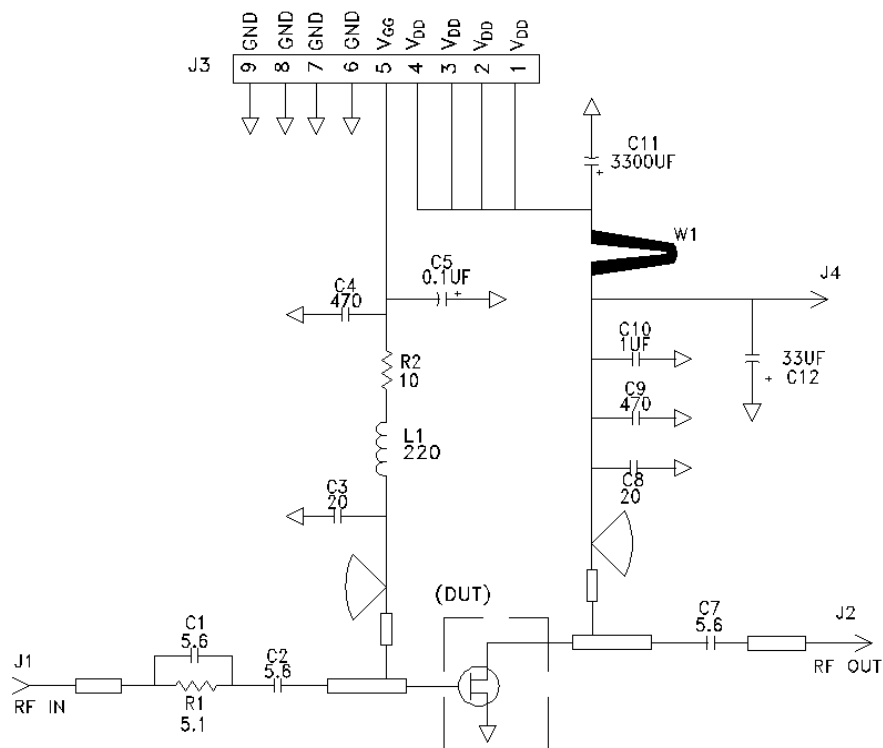
CGHV59350 Power Dissipation De-rating Curve



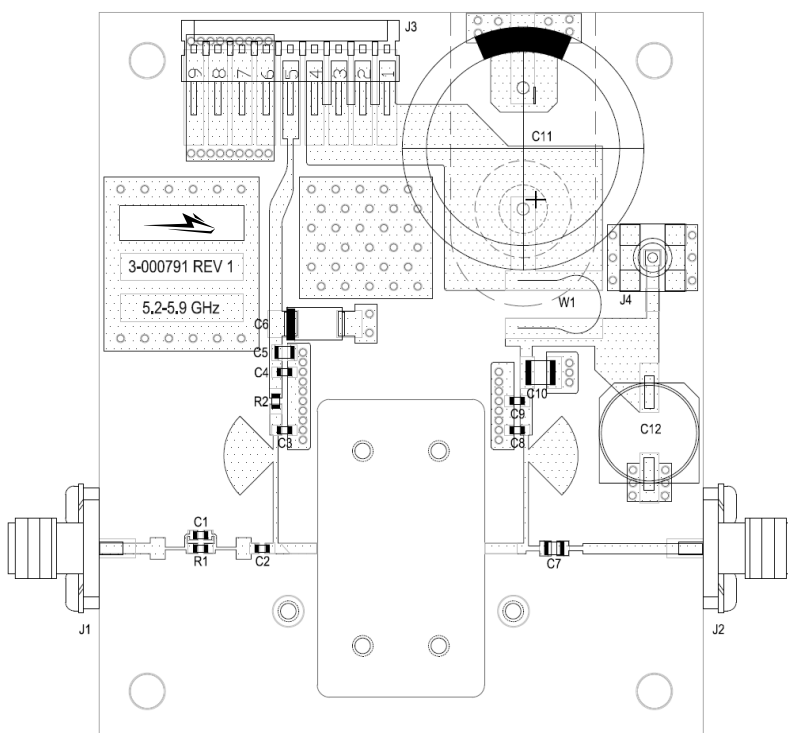
Note

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

CGHV59350-AMP Application Circuit Schematic

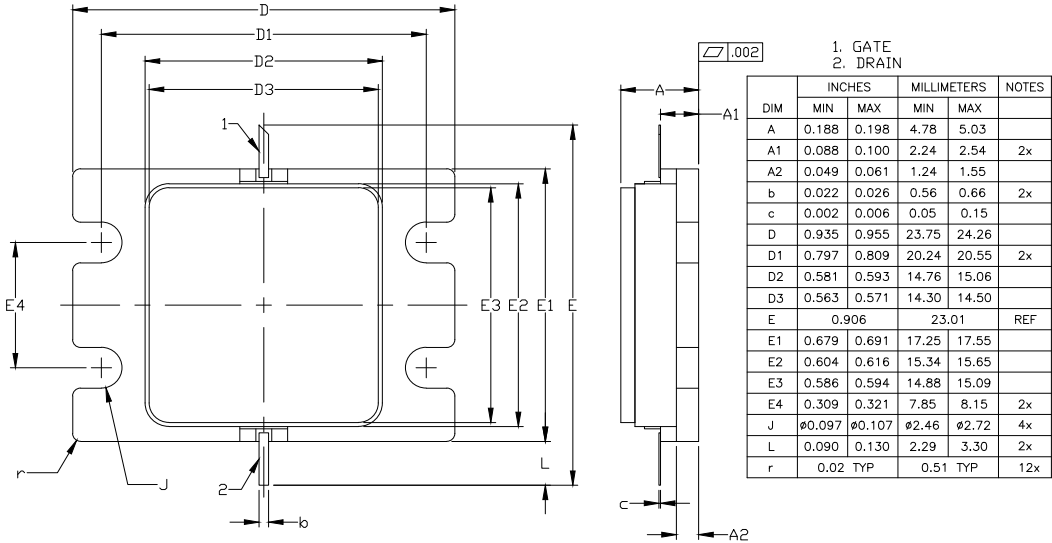


CGHV59350-AMP Application Circuit Outline

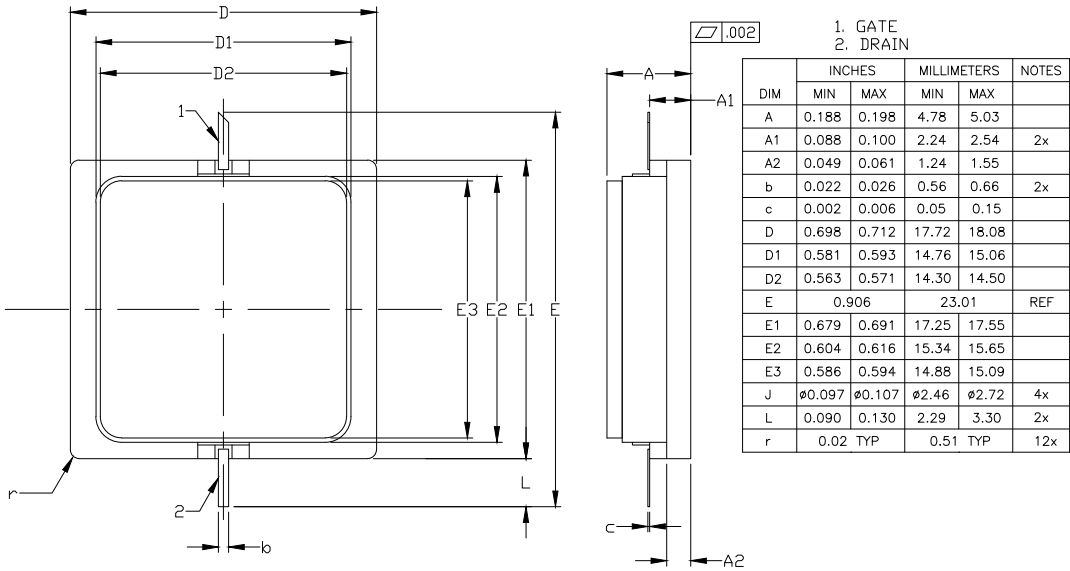


Product Dimensions CGHV59350F (Package Type — 440217)

- 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



Product Dimensions CGHV59350P (Package Type — 440218)





Part Number System

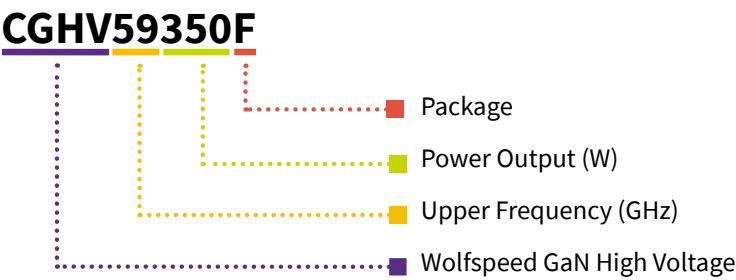


Table 1.

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

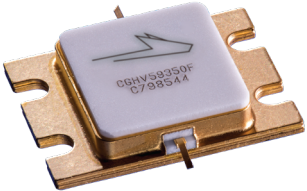
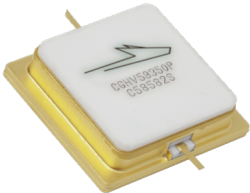
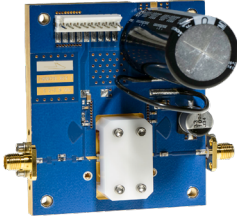
Note:
¹ Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

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	

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