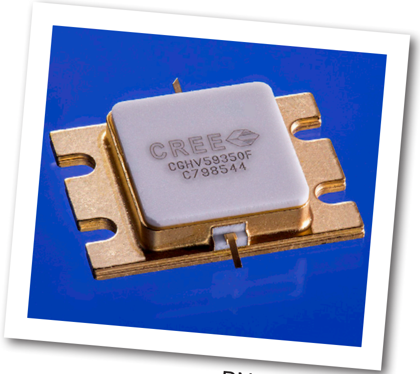
CREE

CGHV59350

350 W, 5200 - 5900 MHz, 50-Ohm Input/Output Matched, GaN HEMT for C-Band Radar Systems

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 package, type 440217 and 440218.



PN: CGHV59350
Package Type: 440217 and 440218

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	440	445	490	W
Gain	10.5	10.5	11	dB
Drain Efficiency	59	54	55	%

Note:
Measured in the CGHV59350-TB under 100 μs pulse width, 10% duty cycle, P_{IN} = 46 dBm

Features

- 5.2 - 5.9 GHz Operation
- 450 W Typical Output Power
- 10.5 dB Power Gain
- 55% Typical Drain Efficiency
- 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}	125	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	$R_{\theta JC}$	0.31	˚C/W	100 µsec, 10%, 85˚C , P_{DISS} = 320 W
Case Operating Temperature	T_C	-40, +85	˚C	

Notes:
[1] Current limit for long term, reliable operation
[2] Refer to the Application Note on soldering at http://www.cree.com/rf/tools-and-support/document-library

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}	48	57.8	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BR}	150	–	–	V_{DC}	V_{GS} = -8 V, I_D = 64 mA

Notes:
[1] Measured on wafer prior to packaging.
[2] Scaled from PCM data.

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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}	–	440	–	W	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm
Output Power at 5.55 GHz	P_{OUT2}	–	445	–	W	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm
Output Power at 5.9 GHz	P_{OUT3}	–	490	–	W	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm
Gain at 5.2 GHz	G_{P1}	–	10.5	–	dB	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm
Gain at 5.55 GHz	G_{P2}	–	10.5	–	dB	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm
Gain at 5.9 GHz	G_{P3}	–	11	–	dB	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm
Drain Efficiency at 5.2 GHz	D_{E1}	–	59	–	%	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm
Drain Efficiency at 5.55 GHz	D_{E2}	–	54	–	%	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm
Drain Efficiency at 5.9 GHz	D_{E3}	–	55	–	%	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = 46 dBm
Small Signal Gain	S21	–	15	–	dB	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = -10 dBm
Input Return Loss	S11	–	-7	–	dB	V_{DD} = 50 V, I_{DQ} = 1 A, P_{IN} = -10 dBm
Output Return Loss	S22	–	-11	–	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

Notes:
[3] Measured in CGHV59350-TB. Pulse Width = 100 µS, Duty Cycle = 10%.

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Typical Performance

Figure 1. - Small Signal S-Parameters
CGHV59350 in Test Fixture
V_{DD} = 50 V, I_{DQ} = 1 A, T_{case} = 25 °C

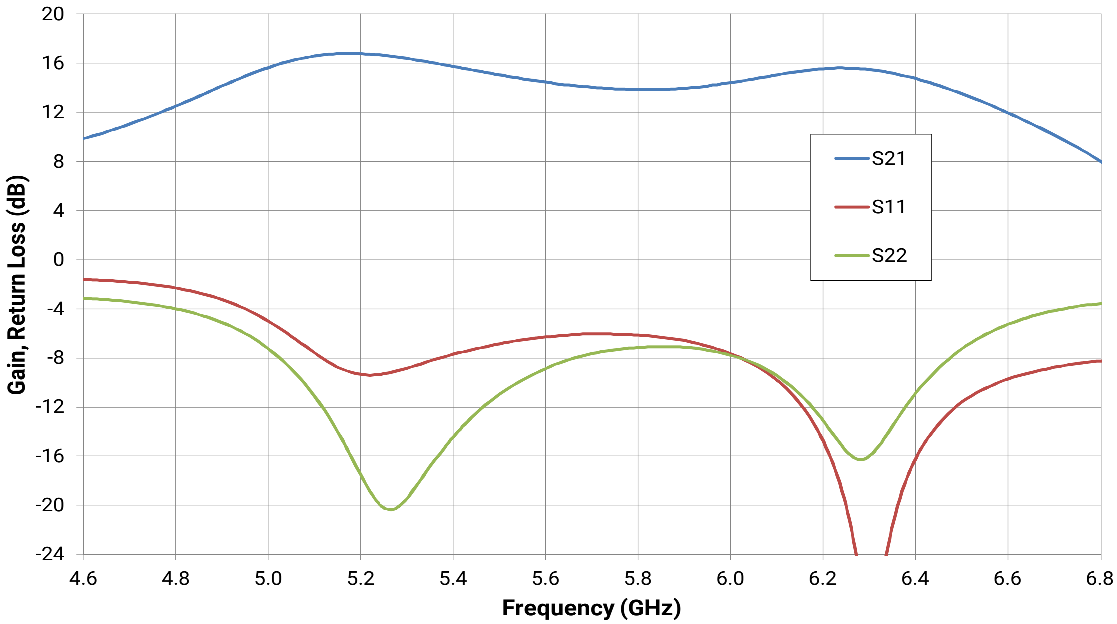
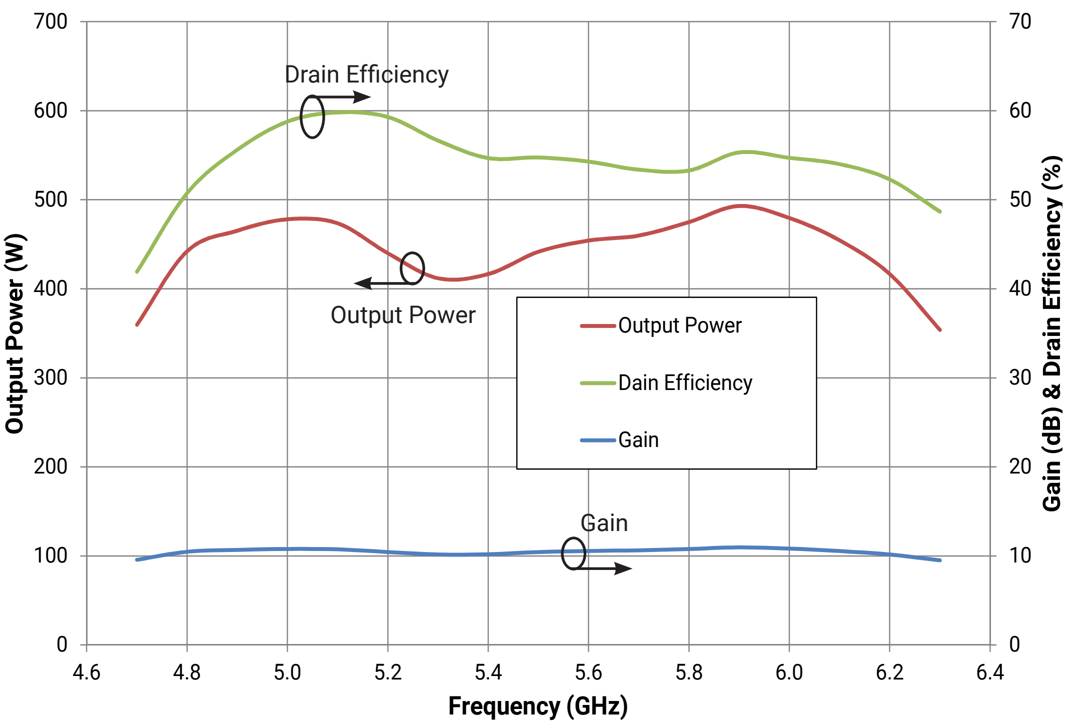


Figure 2. - CGHV59350 Pout, D_{Eff}, and Gain vs. Frequency at T_{case} = 25 °C
V_{DD} = 50V, I_{DQ}=1.0 A, P_{IN}=46 dBm, Pulse Width = 100μS, Duty Cycle = 10%



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Typical Performance

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

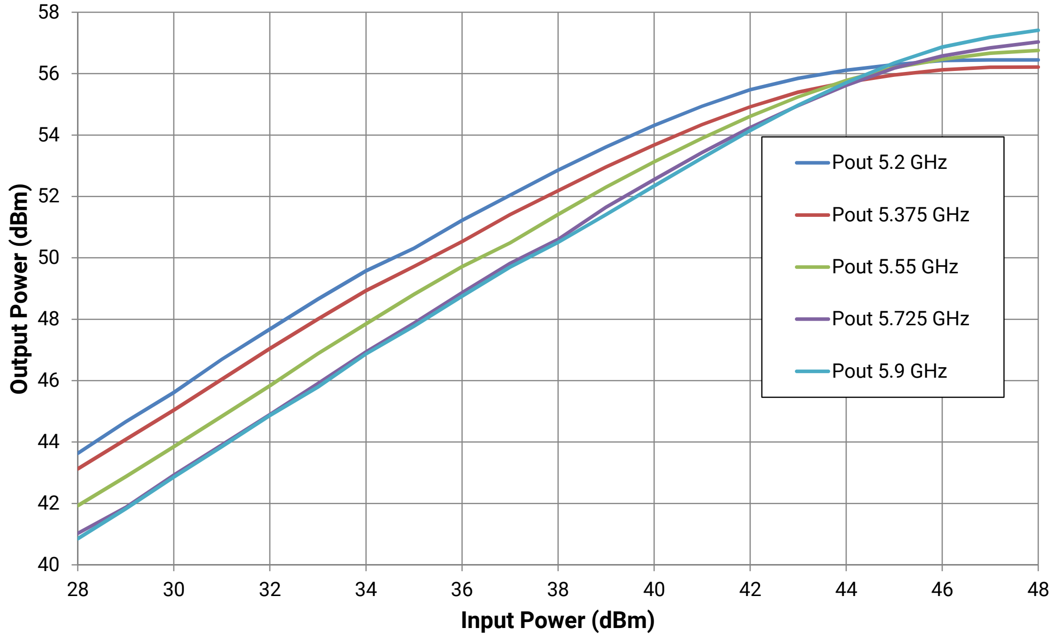
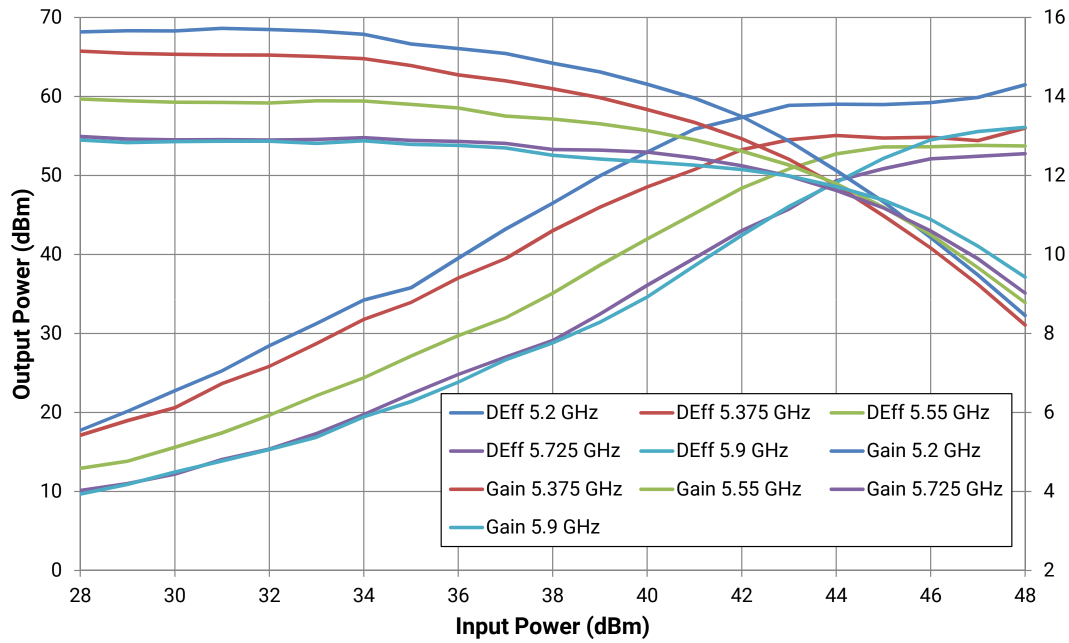


Figure 4. - CGHV59350 Output Power vs. Input Power
V_{DD} = 50V, I_{DQ}= 1.0 A, Pulse Width = 100µS, Duty Cycle = 10%, T_{case} = 25 °C



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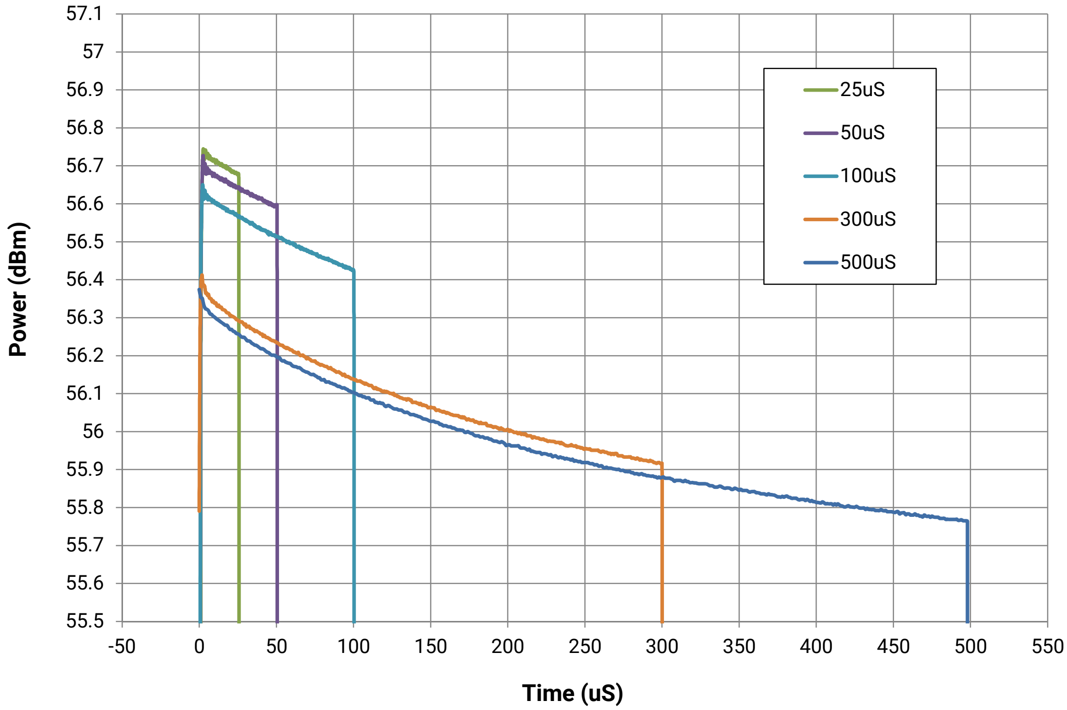
Typical Performance

Figure 5. - Output Power vs. Time

V_{DD} = 50V, P_{IN}=46 dBm, Duty Cycle = 10%



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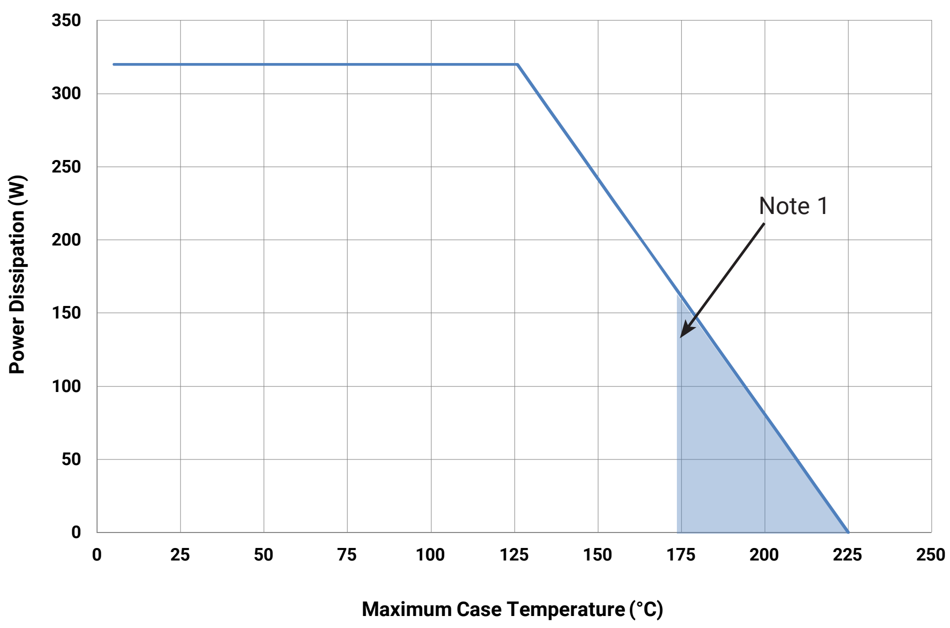
CGHV59350-TB Application Circuit Bill of Materials

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

Figure 4. - Transient Power Dissipation De-Rating Curve



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

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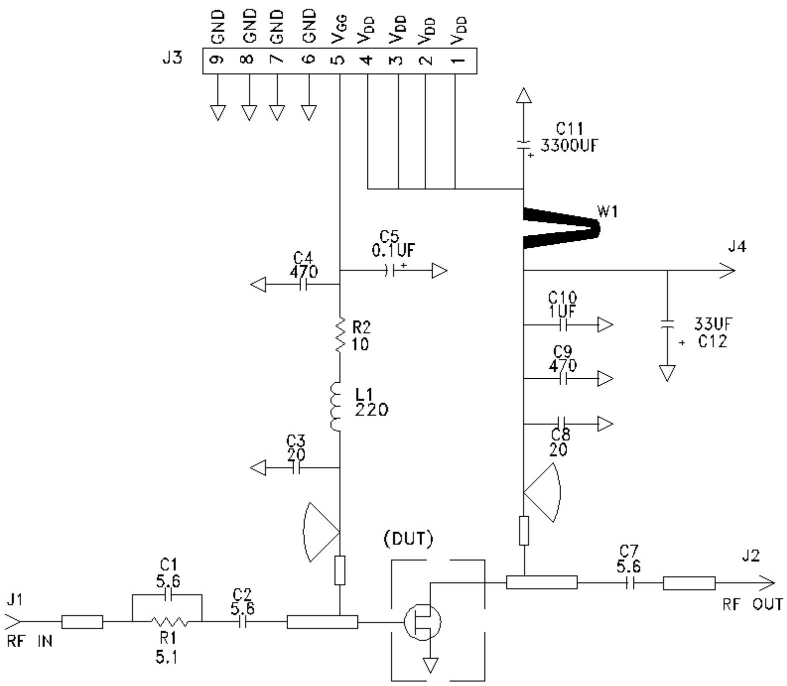
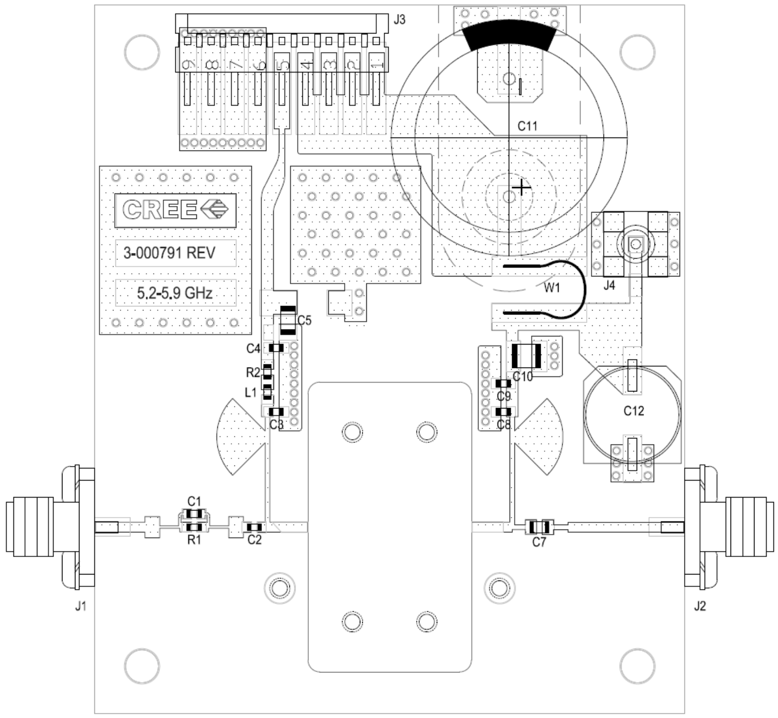
CGHV59350-AMP1 Application Circuit Schematic



CGHV59350-AMP1 Application Circuit Outline



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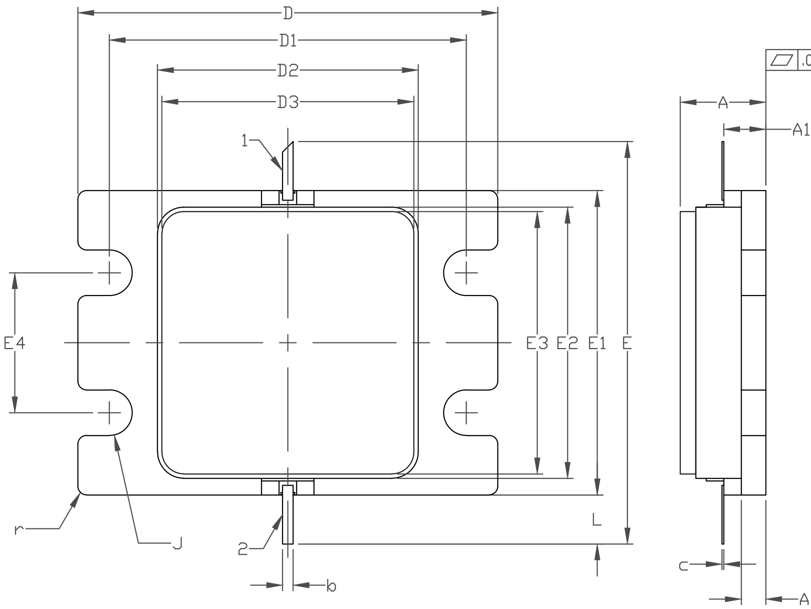
Product Dimensions CGHV59350F (Package Type — 440217)

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

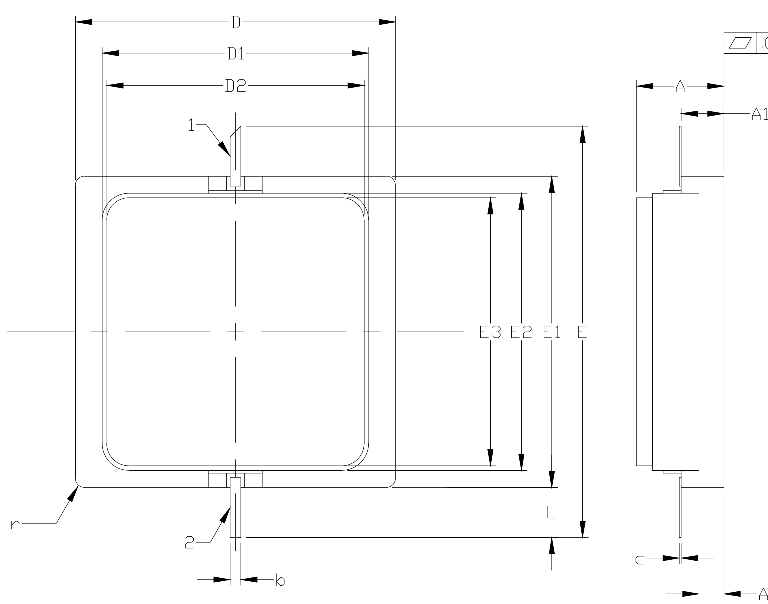


1. GATE
2. DRAIN

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)

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	0.698	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

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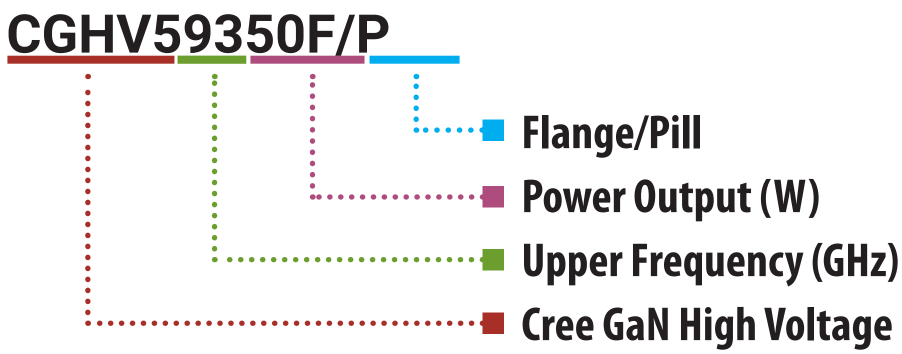
Part Number System



Parameter	Value	Units
Upper Frequency[1]	5.9	GHz
Power Output	350	W
Package	Flange/Pill	-

Table 1.

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

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

Table 2.

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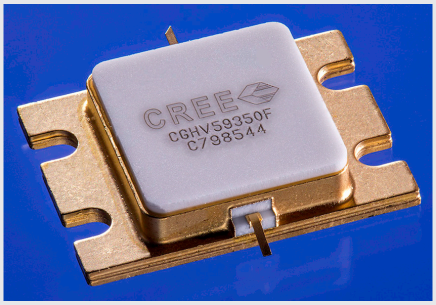
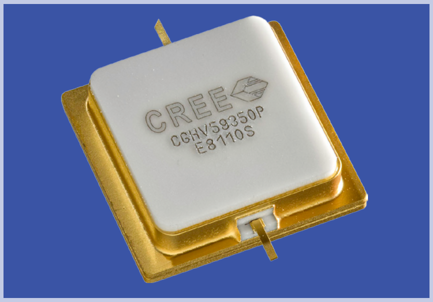
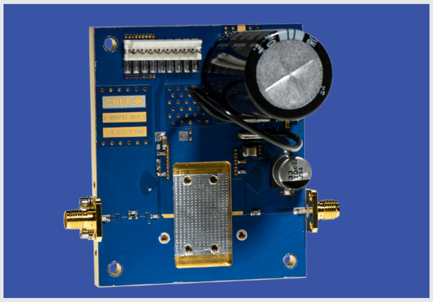
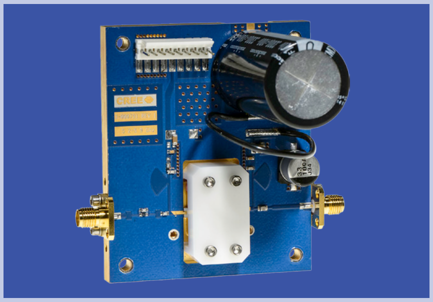
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV59350F	GaN HEMT	Each	
CGHV59350P	GaN HEMT	Each	
CGHV59350-TB	Test board without GaN HEMT	Each	
CGHV59350-AMP1	Test board with GaN HEMT installed	Each	

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