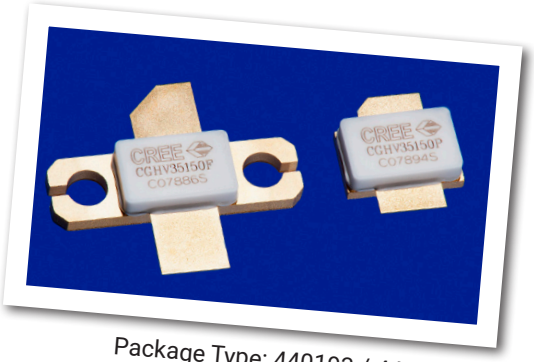
CGHV35150

150 W, 2900 - 3500 MHz, 50V, GaN HEMT for S-Band Radar Systems

Cree's CGHV35150 is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV35150 ideal for 2.9 - 3.5 GHz S-Band radar amplifier applications. The transistor is supplied in a ceramic/metal flange and pill package.



Package Type: 440193 / 440206
PN: CGHV35150F / CGHV35150P

Typical Performance 3.1 - 3.5 GHz (T_C = 85°C)

Parameter	3.1 GHz	3.2 GHz	3.3 GHz	3.4 GHz	3.5 GHz	Units
Output Power	180	180	180	170	150	dB
Gain	13.5	13.5	13.5	13.3	12.7	dBc
Drain Efficiency	50	49	50	49	48	%

Note: Measured in the CGHV35150F-AMP1 application circuit, under 300 µs pulse width, 20% duty cycle, P_{IN} = 39 dBm

Features:

RoHS COMPLIANT

- Rated Power = 150 W @ T_{CASE} = 85°C
- Operating Frequency = 2.9 - 3.5 GHz
- Transient 100 µsec - 300 µsec @ 20% Duty Cycle
- 13.5 dB Power Gain @ T_{CASE} = 85°C
- 50 % Typical Drain Efficiency @ T_{CASE} = 85°C
- Input Matched
- <0.3 dB Pulsed Amplitude Droop

Large Signal Models Available for ADS and MWO

Absolute Maximum Ratings (not simultaneous)

Parameter	Symbol	Rating	Units	Conditions
Pulse Width	PW	300	µs	
Duty Cycle	DC	20	%	
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}	30	mA	25˚C
Maximum Drain Current[1]	I_{DMAX}	12	A	25˚C
Soldering Temperature[2]	T_S	245	˚C	
Screw Torque	τ	40	in-oz	
Pulsed Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	0.81	˚C/W	300 µsec, 20%, 85˚C
Pulsed Thermal Resistance, Junction to Case[4]	$R_{\theta JC}$	0.86	˚C/W	300 µsec, 20%, 85˚C
Case Operating Temperature	T_C	-40, +150	˚C	30 seconds

Note:
[1] Current limit for long term, reliable operation
[2] Refer to the Application Note on soldering at http://www.cree.com/rf/document-library
[3] Measured for the CGHV35150P at P_{DISS} = 150 W
[4] Measured for the CGHV35150F at P_{DISS} = 150 W

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 = 28.8 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	V_{DC}	V_{DS} = 50 V, I_D = 500 mA
Saturated Drain Current[2]	I_{DS}	21.6	25.9	–	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 = 28.8 mA
RF Characteristics[3] (T_C = 85˚C, F_0 = 3.1 - 3.5 GHz unless otherwise noted)						
Output Power at 3.1 GHz	P_{OUT}	130	170	–	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 39 dBm
Output Power at 3.5 GHz	P_{OUT}	100	135	–	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 39 dBm
Gain at 3.1 GHz	G_P	12.0	13.3	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 39 dBm
Gain at 3.5 GHz	G_P	11.0	12.3	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 39 dBm
Drain Efficiency at 3.1 GHz	D_E	40	47	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 39 dBm
Drain Efficiency at 3.5 GHz	D_E	40	44	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 39 dBm
Amplitude Droop	D	–	-0.3	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 39 dBm
Output Mismatch Stress	VSWR	–	–	5 : 1	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 39 dBm Pulsed

Notes:
[1] Measured on wafer prior to packaging.
[2] Scaled from PCM data.
[3] Measured in CGHV35150-AMP1. Pulse Width = 300 µS, Duty Cycle = 20%.

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Typical Performance

Figure 1. - CGHV35150 Typical Sparameters
V_{DD} = 50 V, I_{DQ} = 500 mA, T_{CASE} = 25°C

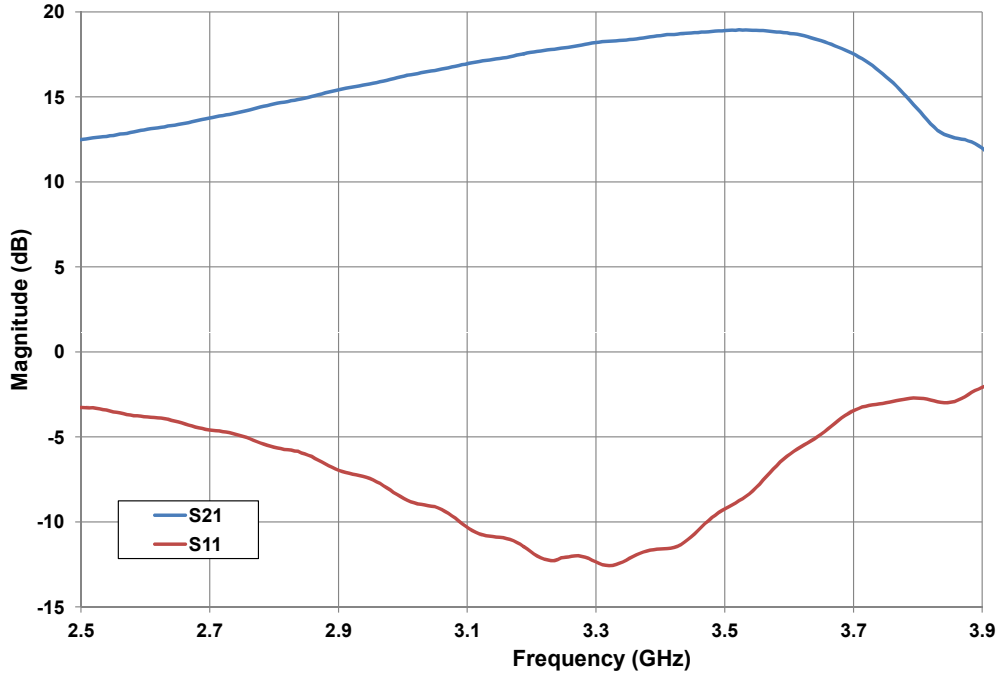
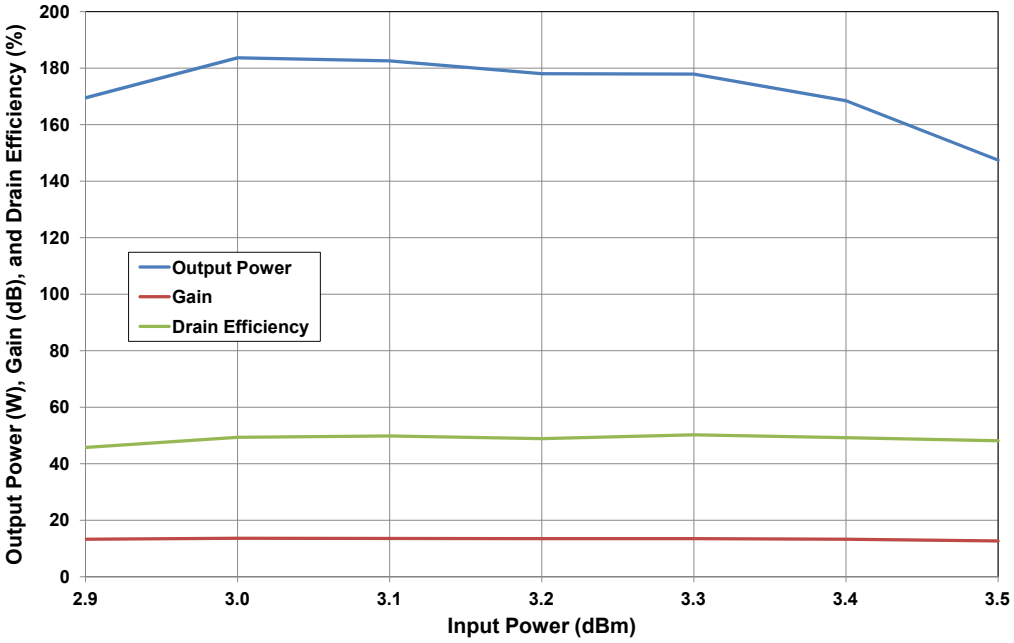


Figure 2. - CGHV35150 Typical RF Results
V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 39 dBm
Tplate = 85°C, Pulse Width = 300 µs, Duty Cycle = 20 %



Cree, Inc.
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Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
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Typical Performance

Figure 3. - CGHV35150 Output Power vs Input Power
V_{DD} = 50 V, I_{DQ} = 500 mA, T_{PLATE} = 85°C, Pulse Width = 300 µs, Duty Cycle = 20%

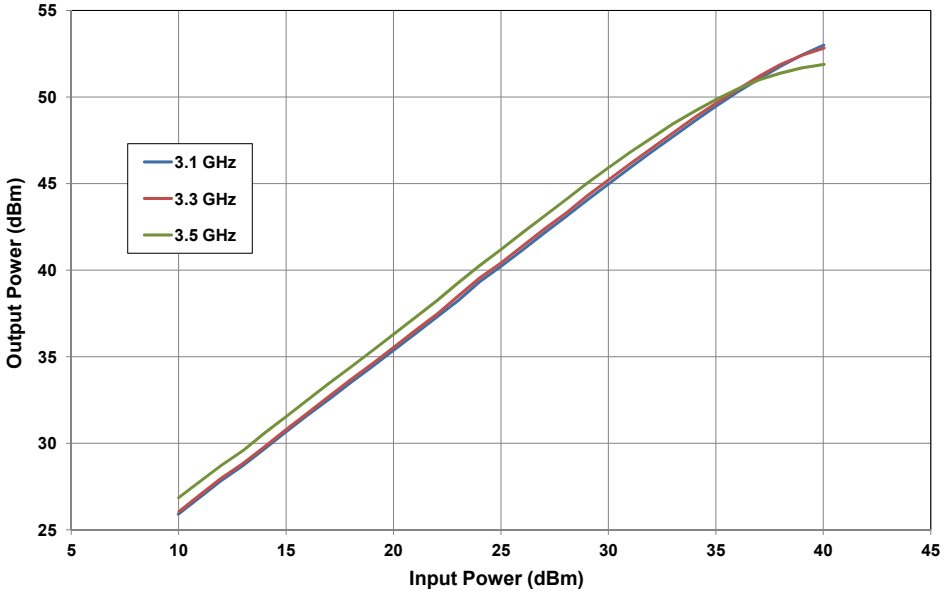
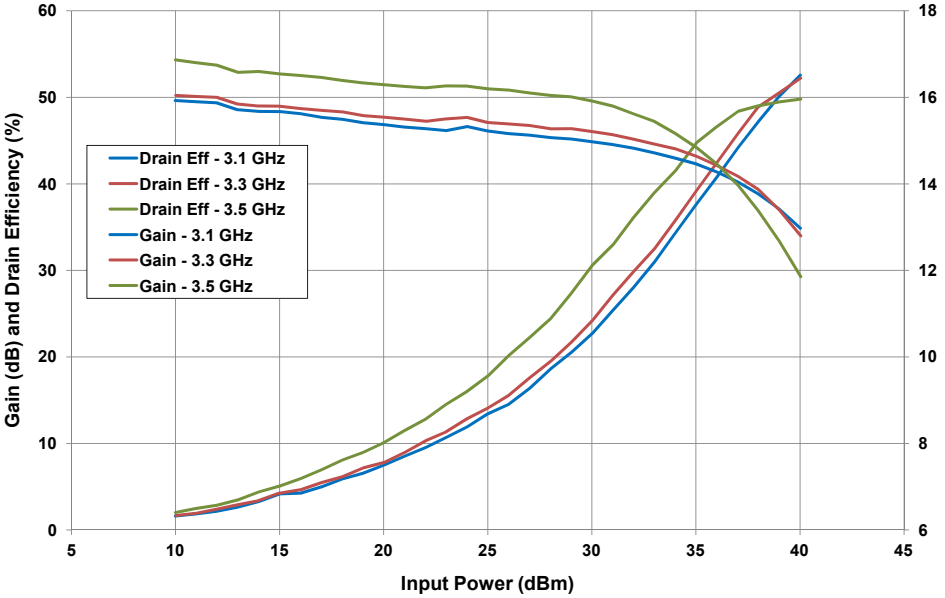


Figure 4. - CGHV35150 Gain and Drain Efficiency vs Input Power
V_{DD} = 50 V, I_{DQ} = 500 mA, Tplate = 85°C, Pulse Width = 300 µs, Duty Cycle = 20 %



Electrostatic Discharge (ESD) Classifications

Gain

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (200 < 500 V)	JEDEC JESD22 C101-C

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Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
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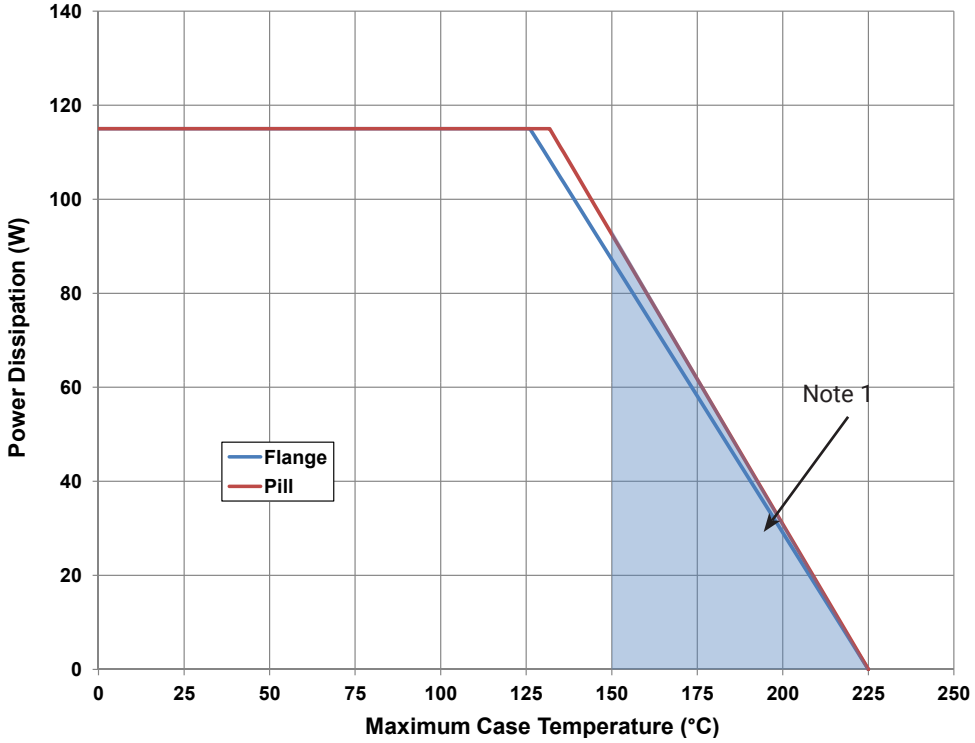
CGHV35150 Power Dissipation De-rating Curve

Figure 5. - CGHV35150 Transient Power Dissipation De-Rating Curve



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

CGHV35150-AMP1 Application Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 511 OHM, +/- 1%, 1/16W, 0603	1
R2	RES, 5.1 OHM, +/- 1%, 1/16W, 0603	1
C1,C7,C8	CAP, 10pF, +/- 1%, 250V, 0805	3
C2	CAP, 6.8pF, +/- 0.25 pF,250V, 0603	1
C3	CAP, 10.0pF, +/-5%,250V, 0603	1
C4,C9	CAP, 470PF, 5%, 100V, 0603, X	2
C5,C10	CAP, 33000PF, 0805,100V, X7R	1
C6	CAP 10uF 16V TANTALUM	1
C11	CAP, 1.0UF, 100V, 10%, X7R, 1210	1
C12	CAP, 33 UF, 20%, G CASE	1
C13	CAP, 3300 UF, +/-20%, 100V, ELECTROLYTIC	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, RO4350, 20 MIL THK, CGHV35150	1
Q1	CGHV35150	1

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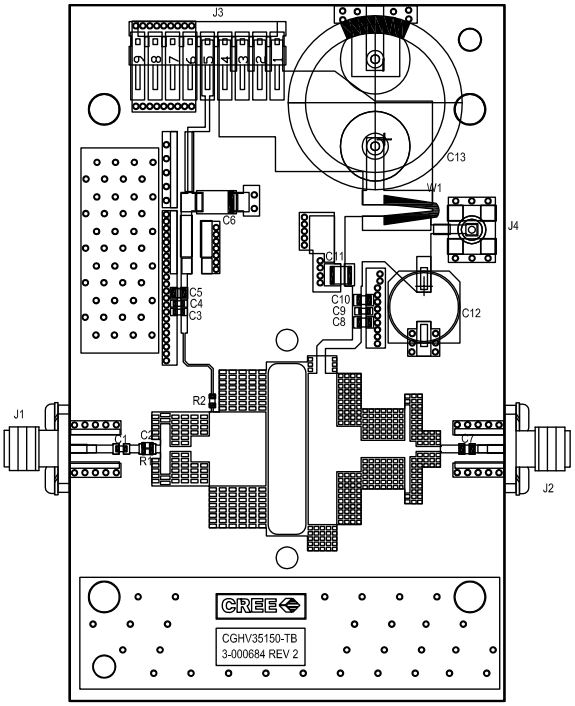
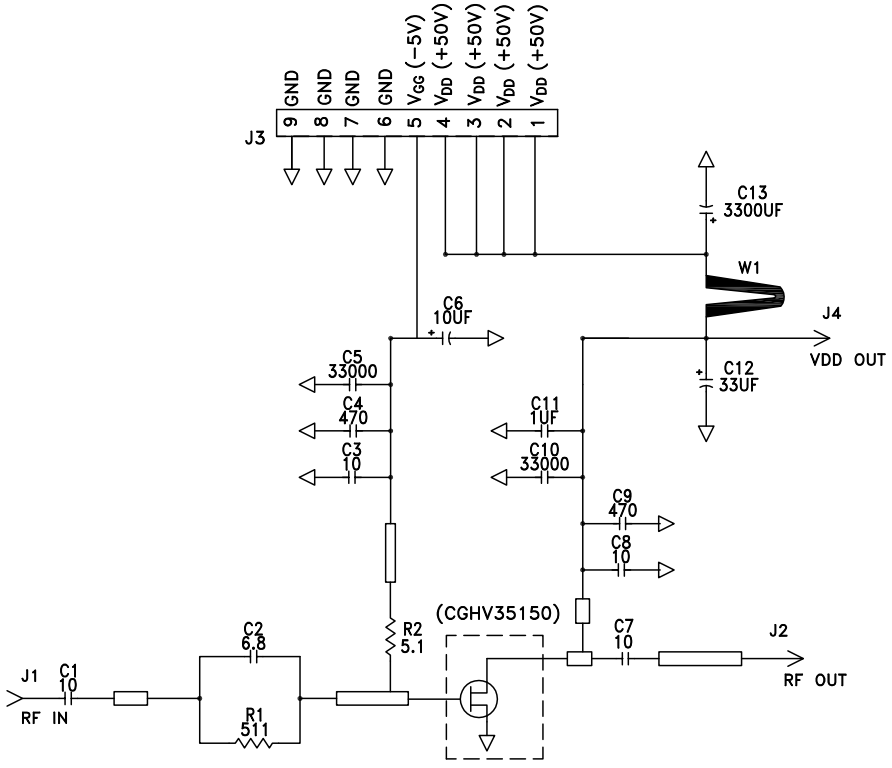
CGHV35150-AMP1 Application Circuit Outline

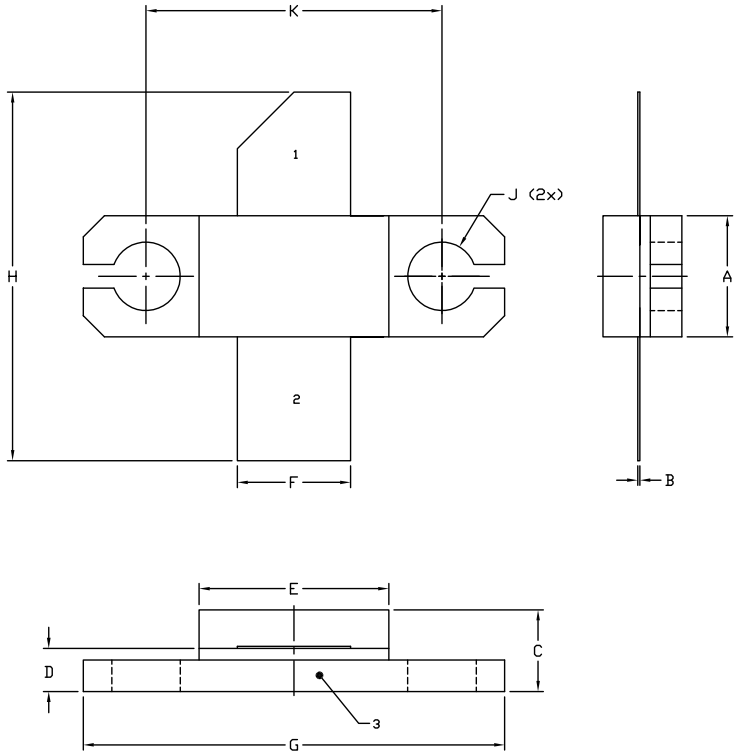


CGHV35150-AMP1 Application Circuit Schematic



Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Product Dimensions CGHV35150F (Package Type — 440193)



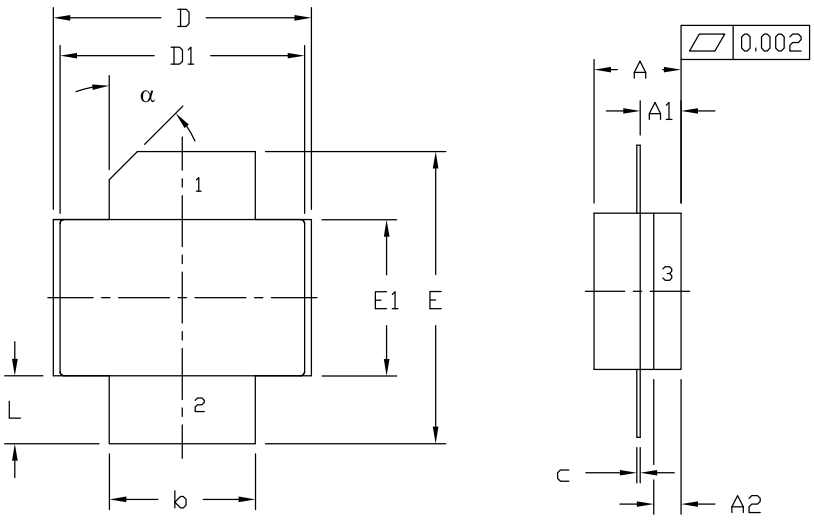
NOTES:

1. DIMENSIONING AND TOLERANICING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
4. LID MAY BE MISALIGNED TO THE BODY OF THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.
5. ALL PLATED SURFACES ARE NI/AU

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.225	0.235	5.72	5.97
B	0.004	0.006	0.10	0.15
C	0.145	0.165	3.68	4.19
D	0.077	0.087	1.96	2.21
E	0.355	0.365	9.02	9.27
F	0.210	0.220	5.33	5.59
G	0.795	0.805	20.19	20.45
H	0.670	0.730	17.02	18.54
J	ø .130		3.30	
k	0.562		14.28	

PIN 1. GATE
PIN 2. DRAIN
PIN 3. SOURCE

Product Dimensions CGHV35150P (Package Type — 440206)



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M - 1994.
2. CONTROLLING DIMENSION: INCH.
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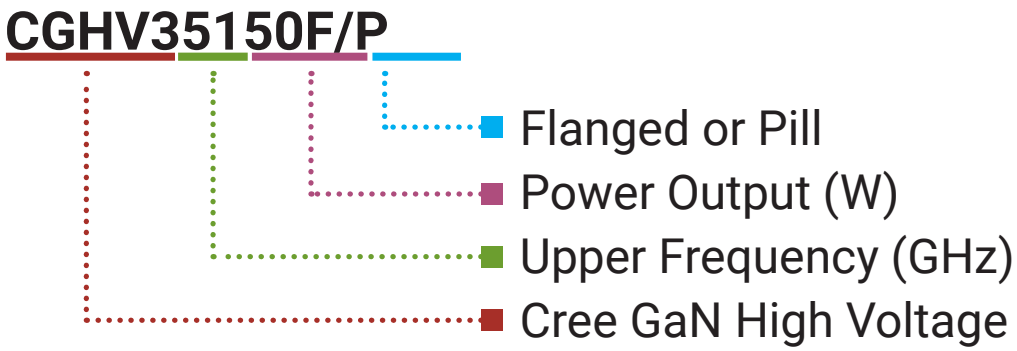
	INCHES		MILLIMETERS		NOTES
DIM	MIN	MAX	MIN	MAX	
A	0.125	0.145	3.18	3.68	
A1	0.057	0.067	1.45	1.70	
A2	0.035	0.045	0.89	1.14	
b	0.210	0.220	5.33	5.59	2x
c	0.004	0.006	0.10	0.15	2x
D	0.375	0.385	9.53	9.78	
D1	0.355	0.365	9.02	9.27	
E	0.400	0.460	10.16	11.68	
E1	0.225	0.235	5.72	5.97	
L	0.085	0.115	2.16	2.92	2x
α	45° REF		45° REF		

PIN 1. GATE
2. DRAIN
3. SOURCE

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Part Number System



Parameter	Value	Units
Upper Frequency[1]	3.5	GHz
Power Output	150	W
Package	Flange	-

Table 1.

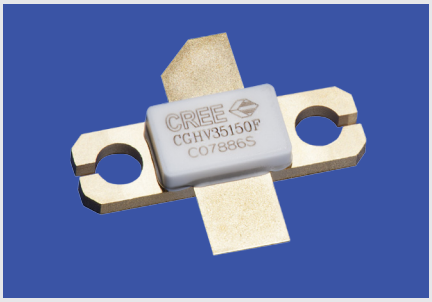
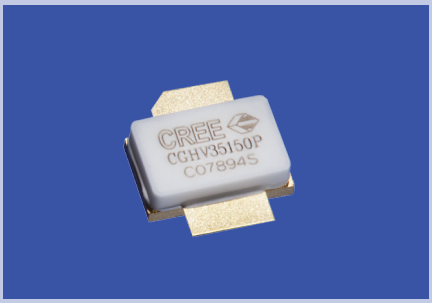
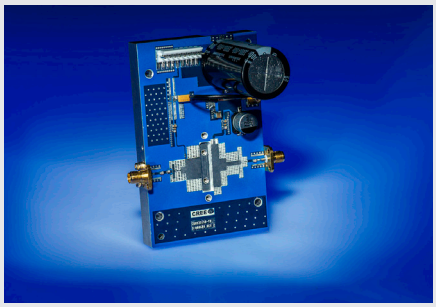
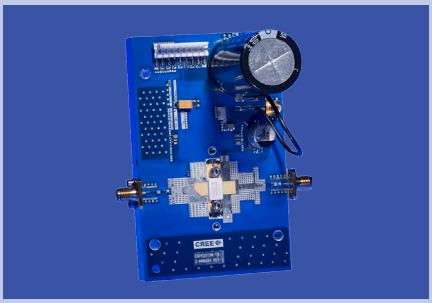
Note[1]: Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

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.

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV35150F	GaN HEMT	Each	
CGHV35150P	GaN HEMT	Each	
CGHV35150F-TB	Test board without GaN HEMT	Each	
CGHV35150F-AMP1	Test board with GaN HEMT installed	Each	

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

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For more information, please contact:

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
www.cree.com/rf

Sarah Miller
Marketing
Cree, RF Components
1.919.407.5302

Ryan Baker
Marketing & Sales
Cree, RF Components
1.919.407.7816

Tom Dekker
Sales Director
Cree, RF Components
1.919.407.5639

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

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Телефон: 8 (812) 309-75-97 (многоканальный)
Факс: 8 (812) 320-03-32
Электронная почта: ocean@oceanchips.ru
Web: http://oceanchips.ru/
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А