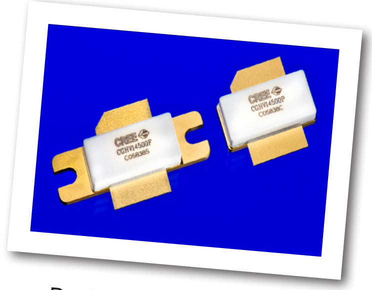
CGHV14500

500 W, 1200 - 1400 MHz, GaN HEMT for L-Band Radar Systems

Cree's CGHV14500 is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV14500 ideal for 1.2 - 1.4 GHz L-Band radar amplifier applications. The transistor could be utilized for band specific applications ranging from 800 through 1600 MHz. The package options are ceramic/metal flange and pill package.



Package Type: 440117, 440133
PN: CGHV14500

Typical Performance Over 1.2-1.4 GHz (T_C = 25˚C) of Demonstration Amplifier

Parameter	1.2 GHz	1.25 GHz	1.3 GHz	1.35 GHz	1.4 GHz	Units
Output Power	545	540	530	530	530	W
Gain	16.4	16.3	16.2	16.2	16.2	dB
Drain Efficiency	69	69	68	66	65	%

Note:
Measured in the CGHV14500-AMP1 amplifier circuit, under 500 μs pulse width, 10% duty cycle, P_{IN} = 41 dBm.

Features

- Reference design amplifier 1.2 - 1.4 GHz Operation
- FET tuning range UHF through 1800 MHz
- 530 W Typical Output Power
- 16 dB Power Gain
- 68% Typical Drain Efficiency
- <0.3 dB Pulsed Amplitude Droop
- Internally pre-matched on input, unmatched output

Large Signal Models Available for ADS and MWO

Rev 3.1 – July 2015

Absolute Maximum Ratings (not simultaneous)

Parameter	Symbol	Rating	Units	Conditions
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}	84	mA	25˚C
Maximum Drain Current[1]	I_{DMAX}	36	A	25˚C
Soldering Temperature[2]	T_S	245	˚C	
Screw Torque	τ	40	in-oz	
CW Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	0.47	˚C/W	P_{DISS} = 334 W, 65˚C
Pulsed Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	0.28	˚C/W	P_{DISS} = 334 W, 500 µsec, 10%, 85˚C
Pulsed Thermal Resistance, Junction to Case[4]	$R_{\theta JC}$	0.31	˚C/W	P_{DISS} = 334 W, 500 µsec, 10%, 85˚C
Case Operating Temperature[5]	T_C	-40, +130	˚C	P_{DISS} = 334 W, 500 µsec, 10%

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 CGHV14500P
[4] Measured for the CGHV14500F
[5] See also, the Power Dissipation De-rating Curve on Page 5

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 = 83.6 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}	62.7	75.2	–	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 = 83.6 mA
RF Characteristics[3] (T_C = 25˚C, F_0 = 1.3 GHz unless otherwise noted)						
Output Power	P_{OUT}	422	530	–	W	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 41 dBm
Drain Efficiency	D_E	63	68	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 41 dBm
Power Gain	G_P	15.25	16.2	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 41 dBm
Pulsed Amplitude Droop	D	–	-0.3	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA
Output Mismatch Stress	VSWR	–	5 : 1	–	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 41 dBm Pulsed

Notes:
[1] Measured on wafer prior to packaging.
[2] Scaled from PCM data.
[3] Measured in CGHV14500-AMP1. Pulse Width = 500 µS, Duty Cycle = 10%.

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Typical Performance

Figure 1. - CGHV14500 Typical Sparameters
V_{DD} = 50 V, I_{DQ} = 500 mA

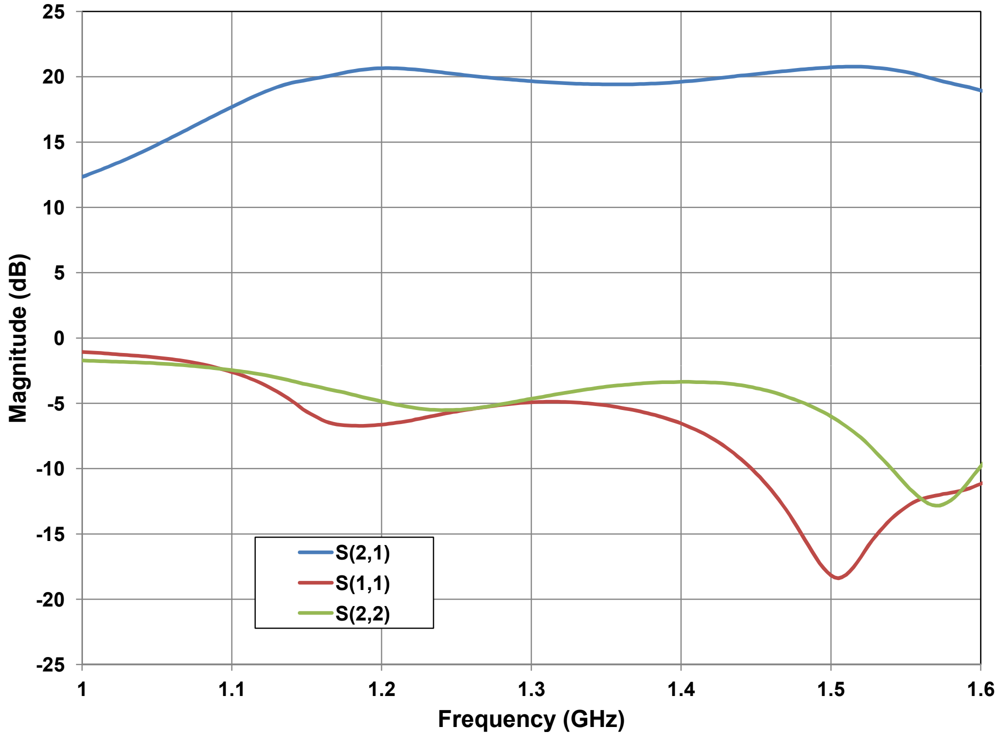
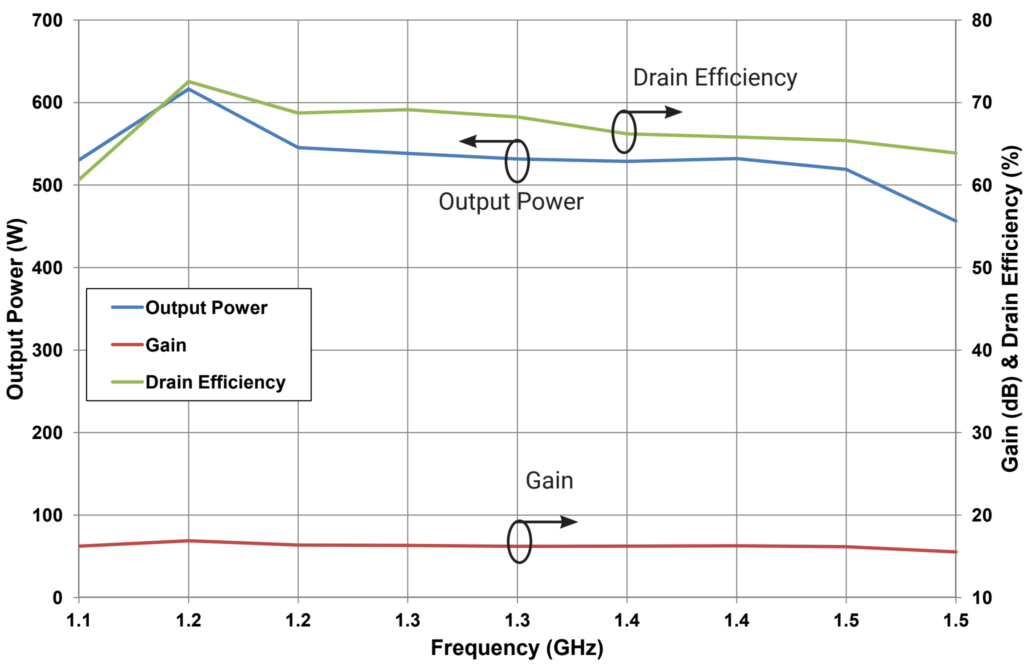


Figure 2. - CGHV14500 Typical RF Results
V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 41 dBm
Tcase = 25°C, Pulse Width = 500 µs, Duty Cycle = 10 %



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Typical Performance

Figure 3. - CGHV14500 Typical RF Results

V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 41 dBm

Tcase = 85°C, Pulse Width = 500 μs, Duty Cycle = 10 %

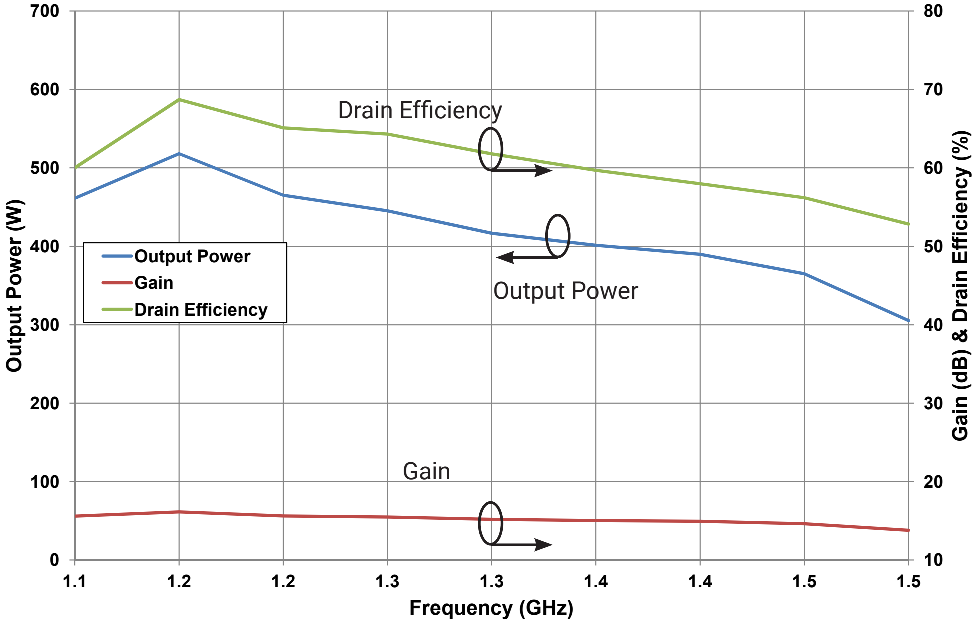
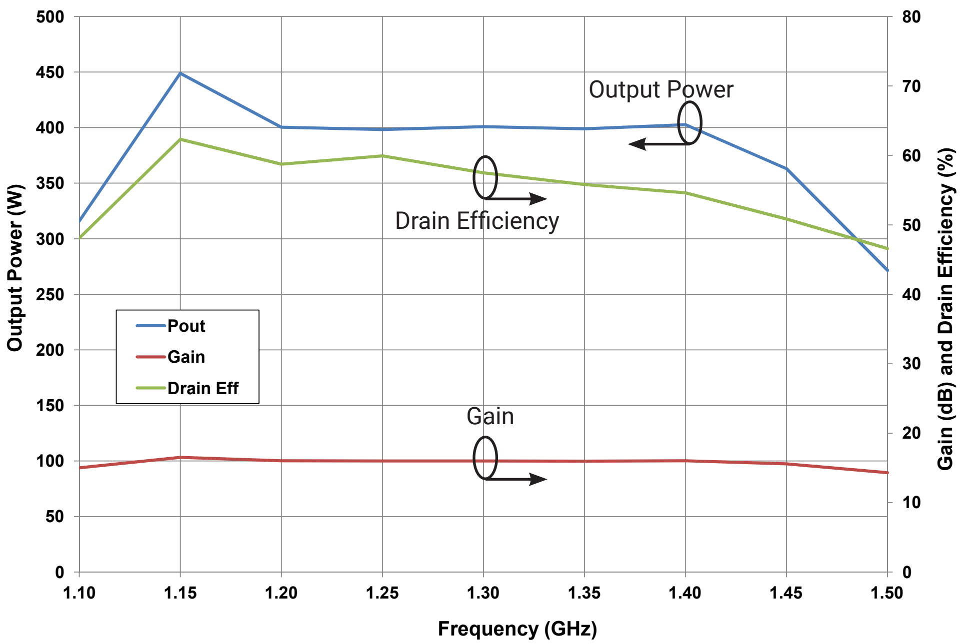


Figure 4. - CGHV14500 Typical CW RF Results

V_{DD} = 50 V, I_{DQ} = 500 mA, P_{IN} = 40 dBm, Tcase = 50°C



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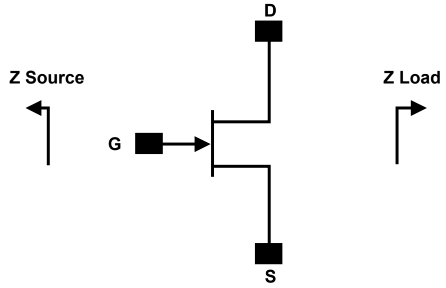
Source and Load Impedances

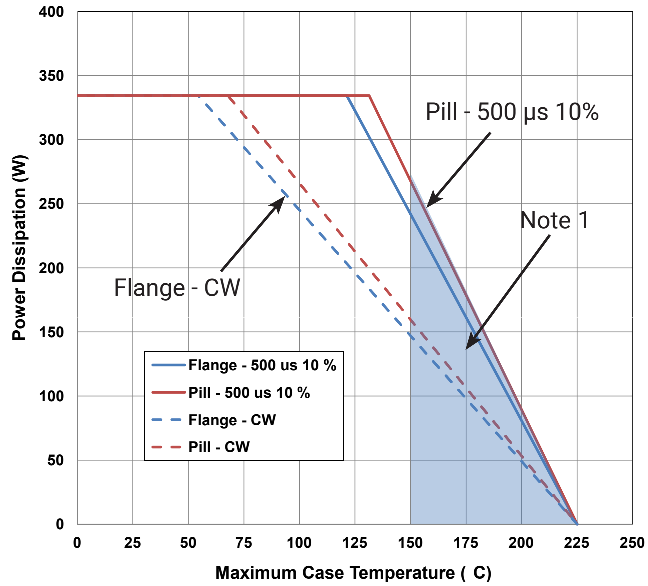


Frequency (MHz)	Z Source	Z Load
900	0.3 - j0.3	2.1 + j1.4
1000	0.3 - j0.4	2.0 +j0.7
1100	0.6 - j0.4	1.8 + j0.9
1200	0.8 - j0.7	1.5 + j0.9
1300	1.1 - j0.7	1.3 + j0.7
1400	1.2 - j0.1	1.2 + j0.5
1500	1.8 - j0.1	1.1 + j0.4

Note 1. V_{DD} = 50 V, I_{DQ} = 500 mA in the 440117 package
Note 2. Optimized for power gain, P_{SAT} and Drain Efficiency
Note 3. When using this device at low frequency, series resistors should be used to maintain amplifier stability

CGHV14500 Power Dissipation De-rating Curve

Figure 5. - CGHV14500 Transient Power Dissipation De-Rating Curve



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

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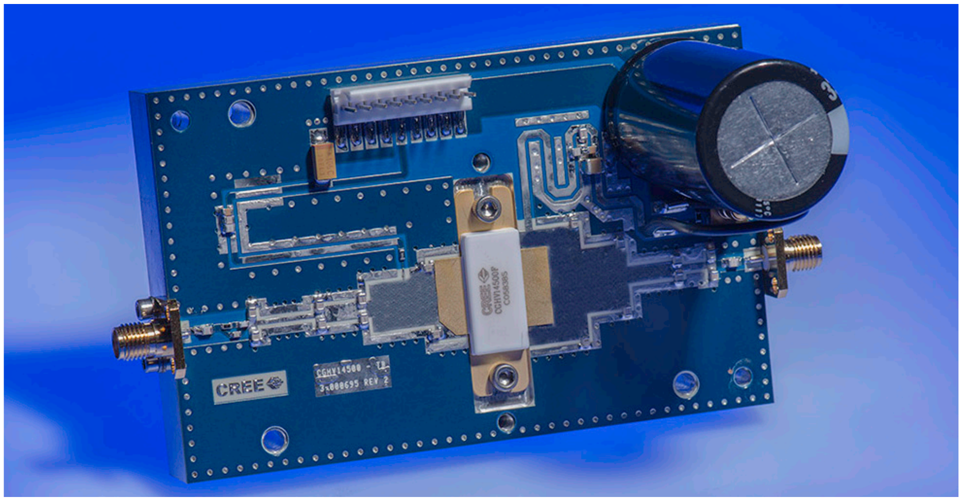
CGHV14500-AMP1 Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 1/16W, 0603, 1%, 562 OHMS	1
R2	RES, 5.1 OHM, +/-1%, 1/16W, 0603	1
R3	RES, 1/16W, 0603, 1%, 4700 OHMS	1
L1	INDUCTOR, CHIP, 6.8 nH, 0603 SMT	1
C1, C23	CAP, 27pF, +/- 5%, 250V, 0805, ATC 600F	2
C2	CAP, 2.0pF, +/- 0.1pF, 0603, ATC	1
C3, C4	CAP, 1.5pF, +/-0.05pF, 250V, 0805, ATC 600F	2
C5,C6	CAP, 1.8pF, +/-0.1pF, 250V, 0805, ATC 600F	2
C7,C8	CAP, 4.3pF, +/-0.1pF, 250V, 0805, ATC 600F	2
C9,C10	CAP, 7.5pF, +/-0.1pF, 250V, 0805, ATC 600F	2
C11,C24	CAP, 47pF,+/-5%, 250V, 0805, ATC 600F	2
C12,C25	CAP, 100pF, +/-5%, 250V, 0805, ATC 600F	2
C13,C26	CAP, 33000PF, 0805,100V, X7R	2
C14	CAP 10uF 16V TANTALUM	1
C15,C16	CAP, 5.6pF, +/-0.1pF, 250V, 0805, ATC 600F	2
C17,C18	CAP, 3.6pF, +/-0.1pF, 250V, 0805, ATC 600F	2
C19,C20	CAP, 2.0pF, +/-0.1pF, 250V, 0805, ATC 600F	2
C21,C22	CAP, 0.7pF, +/-0.05pF, 0805, ATC 600F	2
C27	CAP, 1.0UF, 100V, 10%, X7R, 1210	1
C28	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, RO4350B, 0.020' MIL THK, CGHV14500, 1.2-1.4GHZ	1
Q1	CGHV14500	1

CGHV14500-AMP1 Demonstration Amplifier Circuit



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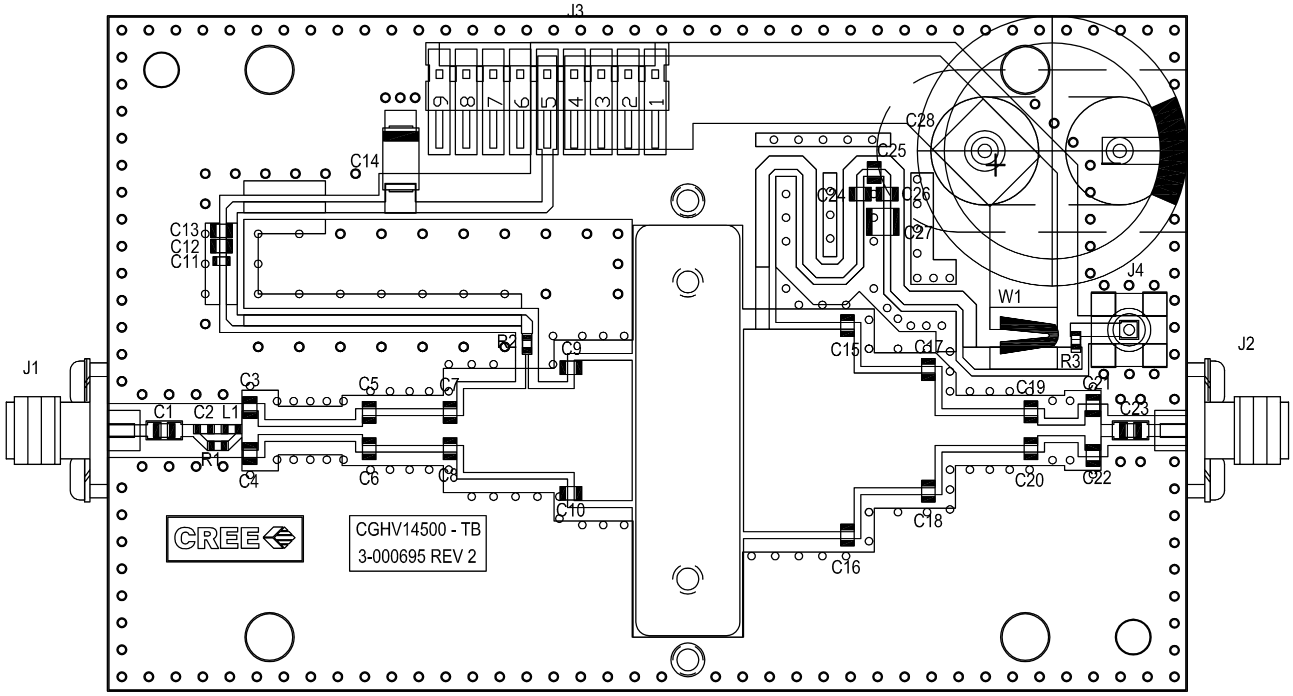
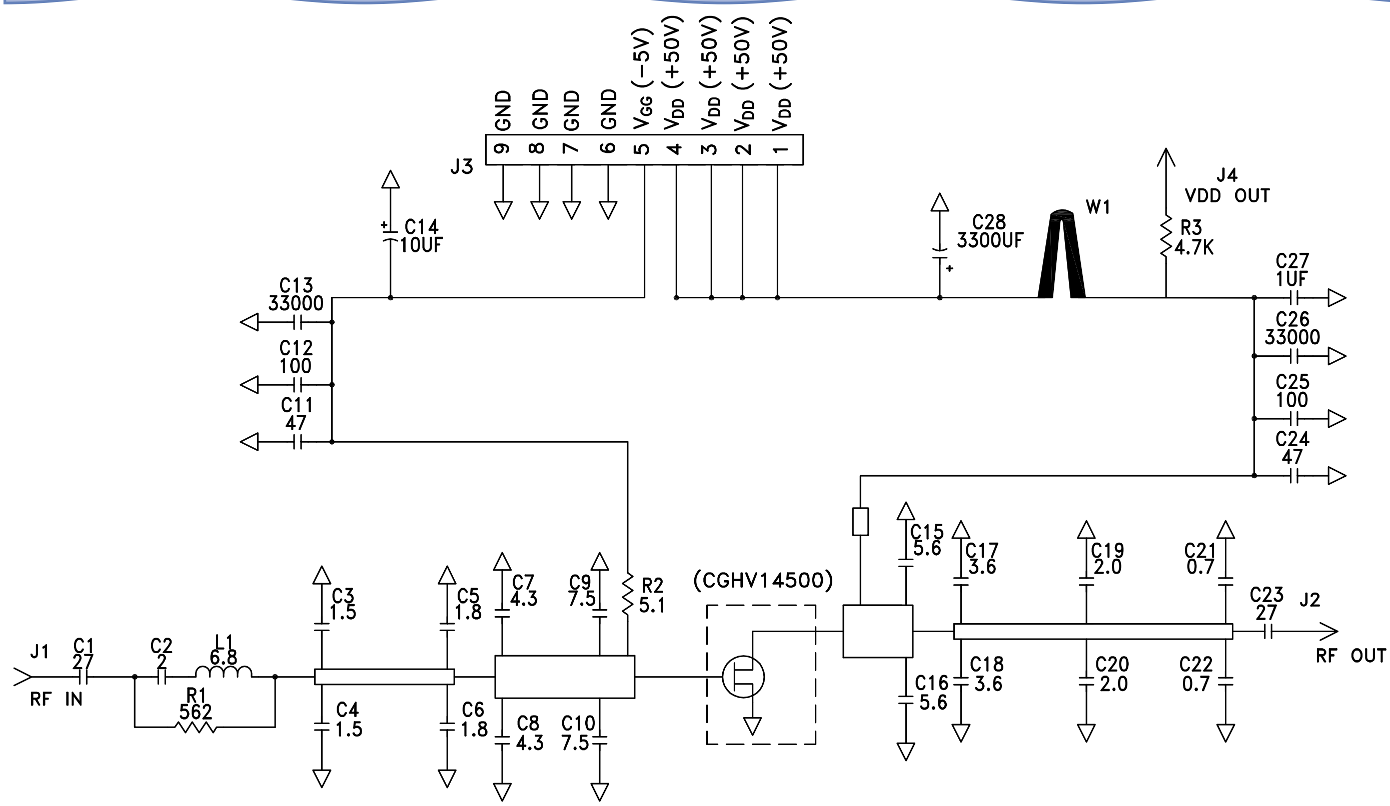
CGHV14500-AMP1 Demonstration Amplifier Circuit Outline



CGHV14500-AMP1 Demonstration Amplifier Circuit Schematic



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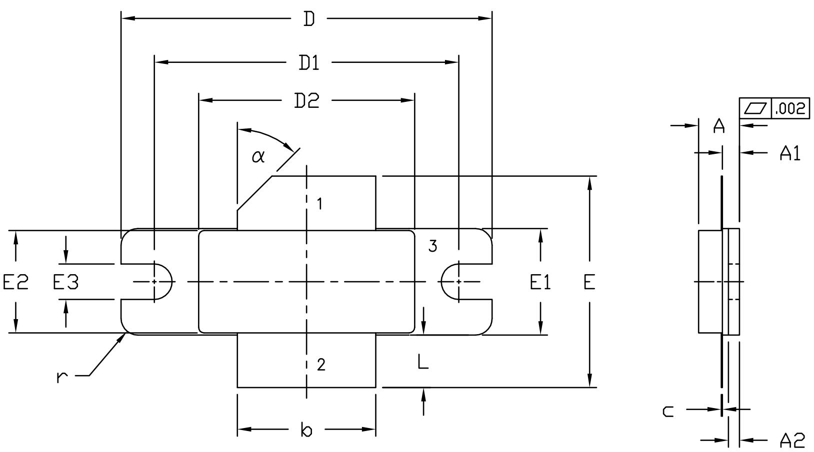
CREE

Product Dimensions CGHV14500F (Package Type — 440117)



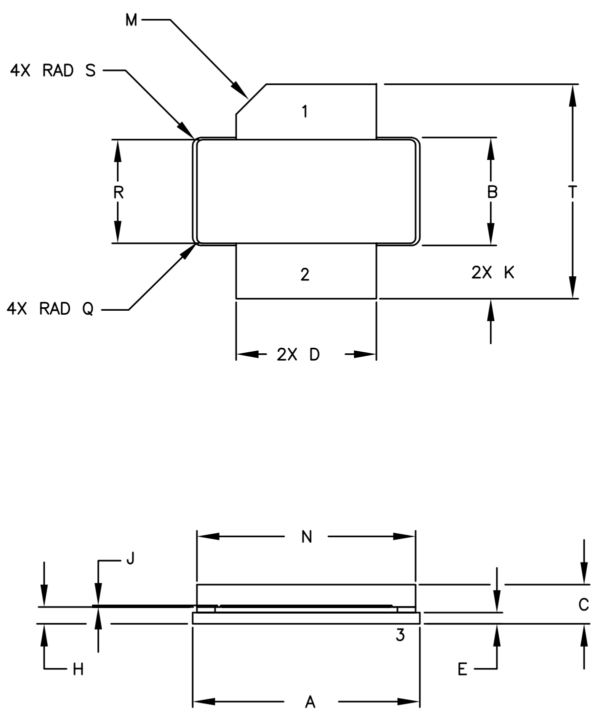
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M - 1994.
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 PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

DIM	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.138	0.158	3.51	4.01	
A1	0.057	0.067	1.45	1.70	
A2	0.035	0.045	0.89	1.14	
b	0.495	0.505	12.57	12.83	2x
c	0.003	0.006	0.08	0.15	
D	1.335	1.345	33.91	34.16	
D1	1.095	1.105	27.81	28.07	
D2	0.773	0.787	19.63	20.00	
E	0.745	0.785	18.92	19.94	
E1	0.380	0.390	9.65	9.91	
E2	0.365	0.375	9.72	9.53	
E3	0.123	0.133	3.12	3.38	
L	0.170	0.210	4.32	5.33	2x
r	0.06 TYP		0.06 TYP		4x
α	45° REF		45° REF		

PIN 1. GATE
2. DRAIN
3. SOURCE

Product Dimensions CGHV14500P (Package Type — 440133)



NOTES:

1. DIMENSIONING AND TOLERANCING 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 PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.805	0.815	20.45	20.70
B	0.380	0.390	9.65	9.91
C	0.135	0.149	3.43	3.78
D	0.495	0.505	12.57	12.83
E	0.035	0.045	.89	1.14
H	0.057	0.067	1.45	1.70
J	0.003	0.006	.08	.15
K	0.170	0.210	4.32	5.33
M	45° REF		45° REF	
N	0.773	0.787	19.63	19.99
Q	0.020 REF		0.51 REF	
R	0.364	0.374	9.25	9.50
S	0.030 REF		0.76 REF	
T	0.745	0.785	18.92	19.94

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

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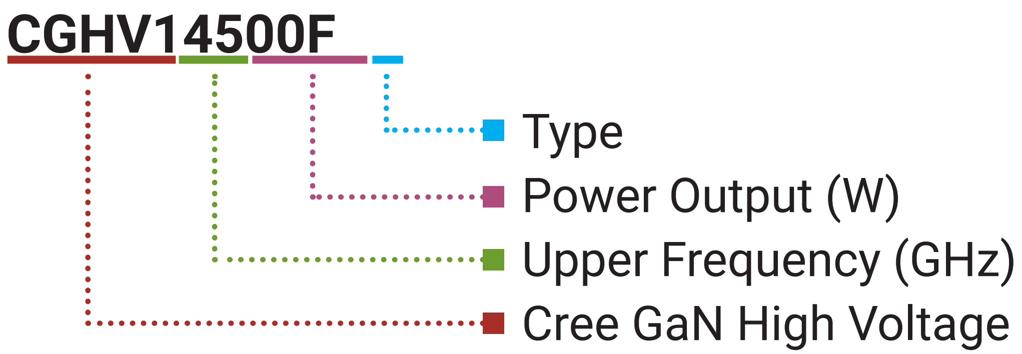
Part Number System



Parameter	Value	Units
Upper Frequency[1]	1.4	GHz
Power Output	500	W
Type	F = Flanged P = Package	-

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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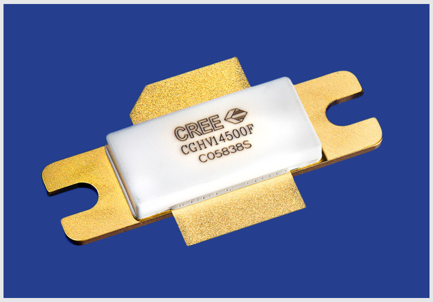
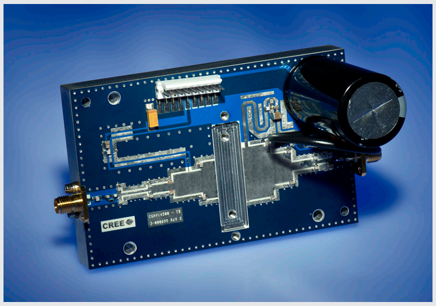
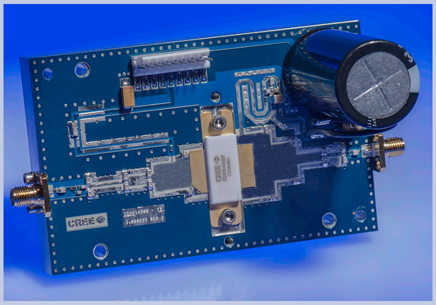
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV14500F	GaN HEMT	Each	
CGHV14500P	GaN HEMT	Each	
CGHV14500v-TB	Test board without GaN HEMT	Each	
CGHV14500F-AMP1	Test board with GaN HEMT installed	Each	

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- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

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- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.

Как с нами связаться

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