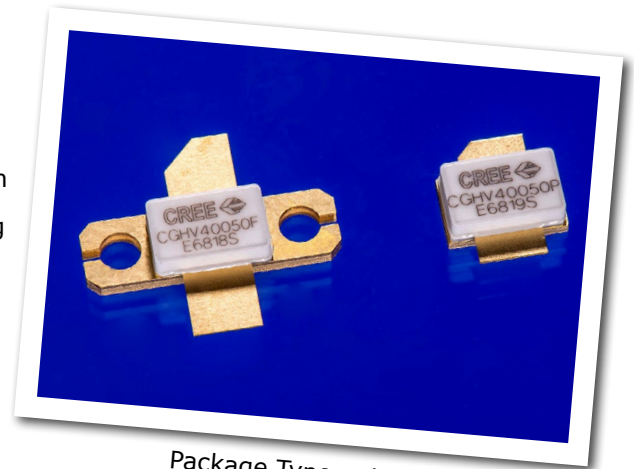


# CGHV40050

## 50 W, DC - 4.0 GHz, 50 V, GaN HEMT

Cree's CGHV40050 is an unmatched, gallium nitride (GaN) high electron mobility transistor (HEMT). The CGHV40050, operating from a 50 volt rail, offers a general purpose, broadband solution to a variety of RF and microwave applications up to 4 GHz. The reference HPA design in the datasheet operates from 800 MHz to 2 GHz operation instantaneously. It is a demonstration amplifier to showcase the CGHV40050's high efficiency, high gain and wide bandwidth capabilities. The device can be used for a range of applications from narrow band UHF, L and S Band as well as multi-octave bandwidth amplifiers up to 4 GHz. The transistor is available in a 2-lead flange and pill package.



Package Types: 440193 & 440206  
PN: CGHV40050F & CGHV40050P

### Typical Performance Over 800 MHz - 2.5 GHz ( $T_c = 25^\circ\text{C}$ ), 50 V

Parameter	800 MHz	1.2 GHz	1.4 GHz	1.8 GHz	2.0 GHz	Units
Small Signal Gain	17.6	16.9	17.7	17.5	14.8	dB
Saturated Output Power	65	70	63	77	60	W
Drain Efficiency @ $P_{SAT}$	63	63	60	53	52	%
Input Return Loss	5	5.5	4.2	8	5	dB

Note:  
Measured CW in the CGHV40050F-TB application circuit.

### Features

- Up to 4 GHz Operation
- 50 W Typical Output Power
- 17.5 dB Small Signal Gain at 1.8 GHz
- Application Circuit for 0.8 - 2.0 GHz
- 55 % Efficiency at  $P_{SAT}$
- 50 V Operation



Large Signal Models Available for SiC & GaN



## Absolute Maximum Ratings (not simultaneous) at 25 °C Case Temperature

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	$V_{DSS}$	150	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	$I_{GMAX}$	10.4	mA	25 °C
Maximum Drain Current <sup>1</sup>	$I_{DMAX}$	6.3	A	25 °C
Soldering Temperature <sup>2</sup>	$T_S$	245	°C	
Screw Torque	$\tau$	40	in-oz	
Thermal Resistance, Junction to Case <sup>3</sup>	$R_{\theta JC}$	3.04	°C/W	85 °C
Thermal Resistance, Junction to Case <sup>4</sup>	$R_{\theta JC}$	3.11	°C/W	85 °C
Case Operating Temperature <sup>5</sup>	$T_C$	-40, +80	°C	30 seconds

Note:

<sup>1</sup> Current limit for long term, reliable operation

<sup>2</sup> Refer to the Application Note on soldering at [www.cree.com/products/wireless\\_appnotes.asp](http://www.cree.com/products/wireless_appnotes.asp)

<sup>3</sup> Measured for the CGHV40050P at  $P_{DISS} = 41.6$  W.

<sup>4</sup> Measured for the CGHV40050F at  $P_{DISS} = 41.6$  W.

<sup>5</sup> See also, Power Derating Curve on Page 7

## Electrical Characteristics ( $T_C = 25$ °C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics<sup>1</sup></b>						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	$V_{DC}$	$V_{DS} = 10$ V, $I_D = 10.4$ mA
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	$V_{DC}$	$V_{DS} = 50$ V, $I_D = 0.3$ A
Saturated Drain Current <sup>2</sup>	$I_{DS}$	8.4	10.4	-	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	$V_{BR}$	150	-	-	$V_{DC}$	$V_{GS} = -8$ V, $I_D = 10.4$ mA
<b>RF Characteristics<sup>3</sup> (<math>T_C = 25</math> °C, <math>F_0 = 1.8</math> GHz unless otherwise noted)</b>						
Small Signal Gain	$G_{SS}$	-	17.5	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 0.3$ A
Power Gain	$G_P$	-	12.5	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 0.3$ A, $P_{OUT} = P_{SAT}$
Power Output at Saturation <sup>4</sup>	$P_{SAT}$	-	77	-	W	$V_{DD} = 50$ V, $I_{DQ} = 0.3$ A
Drain Efficiency	$\eta$	-	53	-	%	$V_{DD} = 50$ V, $I_{DQ} = 0.3$ A, $P_{OUT} = P_{SAT}$
Output Mismatch Stress	VSWR	-	-	10 : 1	$\Psi$	No damage at all phase angles, $V_{DD} = 50$ V, $I_{DQ} = 0.3$ A, $P_{OUT} = 50$ W CW
<b>Dynamic Characteristics<sup>5</sup></b>						
Input Capacitance	$C_{GS}$	-	16	-	pF	$V_{DS} = 50$ V, $V_{GS} = -8$ V, $f = 1$ MHz
Output Capacitance	$C_{DS}$	-	5	-	pF	$V_{DS} = 50$ V, $V_{GS} = -8$ V, $f = 1$ MHz
Feedback Capacitance	$C_{GD}$	-	0.3	-	pF	$V_{DS} = 50$ V, $V_{GS} = -8$ V, $f = 1$ MHz

Notes:

<sup>1</sup> Measured on wafer prior to packaging.

<sup>2</sup> Scaled from PCM data.

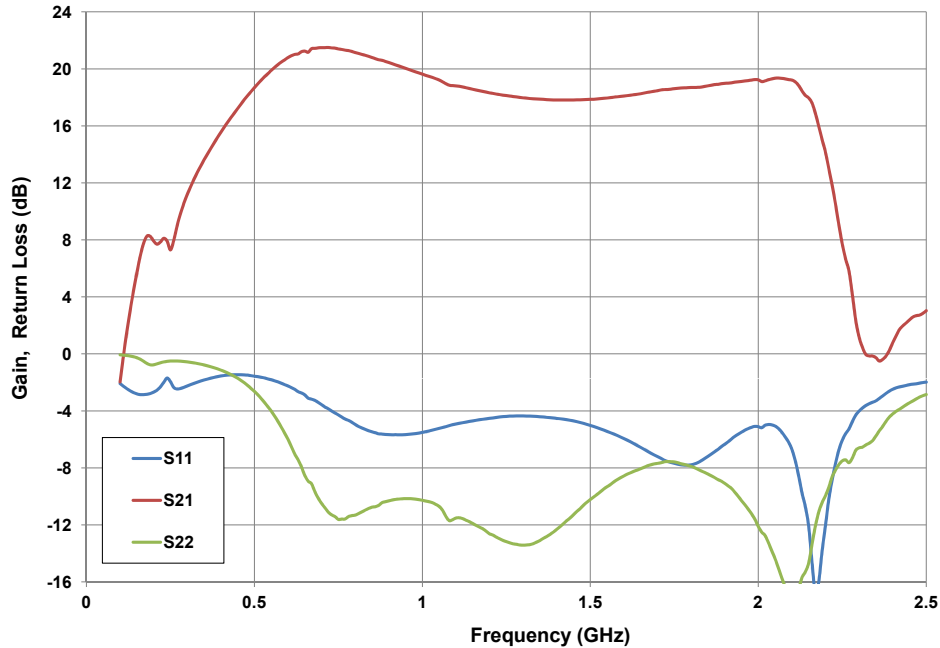
<sup>3</sup> Measured in CGHV40050-TB.

<sup>4</sup>  $P_{SAT}$  is defined as  $I_G = 1$  mA

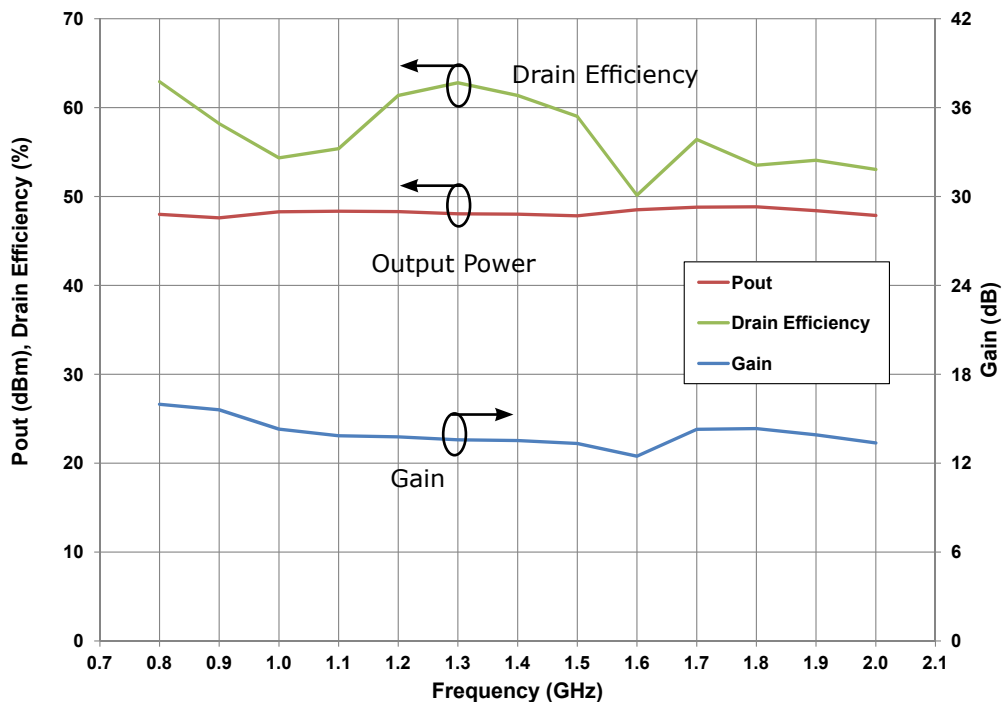
<sup>5</sup> Includes package

## CGHV40050 Typical Performance

**Figure 1. - Small Signal Gain and Return Losses versus Frequency of the CGHV40050 in the application circuit CGHV40050-TB**  
 $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 300\text{ mA}$ ,  $T_{case} = 25^\circ\text{C}$

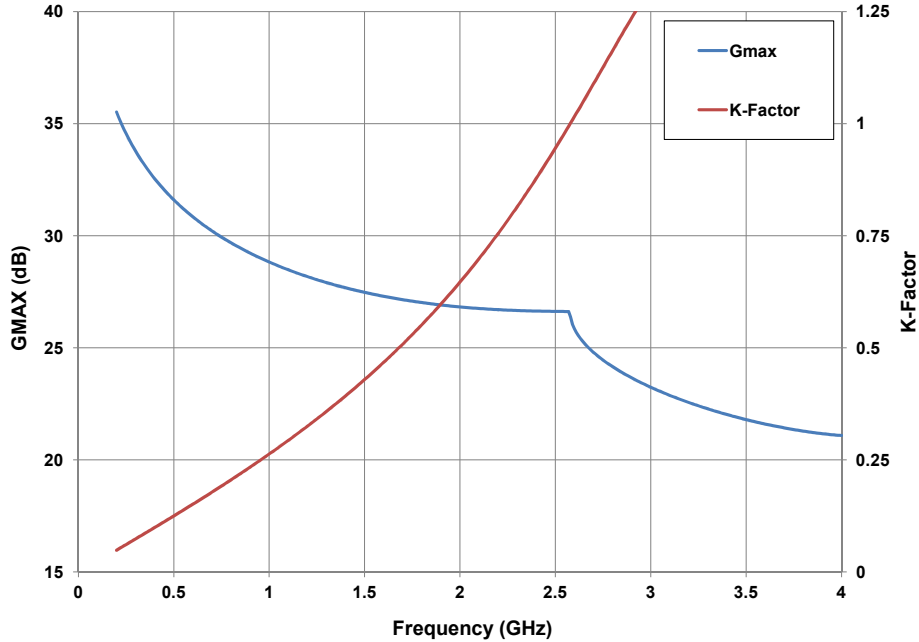


**Figure 2. - Gain, Output Power and Drain Efficiency vs Frequency of the CGHV40050 measured in Broadband Amplifier Circuit CGHV40050-TB**  
 $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 300\text{ mA}$ ,  $T_{case} = 25^\circ\text{C}$

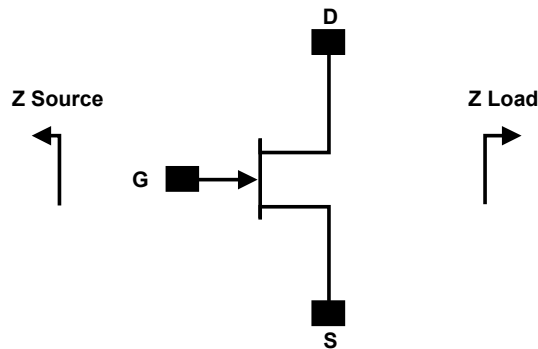


## CGHV40050 Typical Performance

**Figure 3. -  $G_{MAX}$  and K-Factor vs Frequency**  
 $V_{DD} = 50V, I_{DQ} = 300\text{ mA}, T_{case} = 25^\circ C$



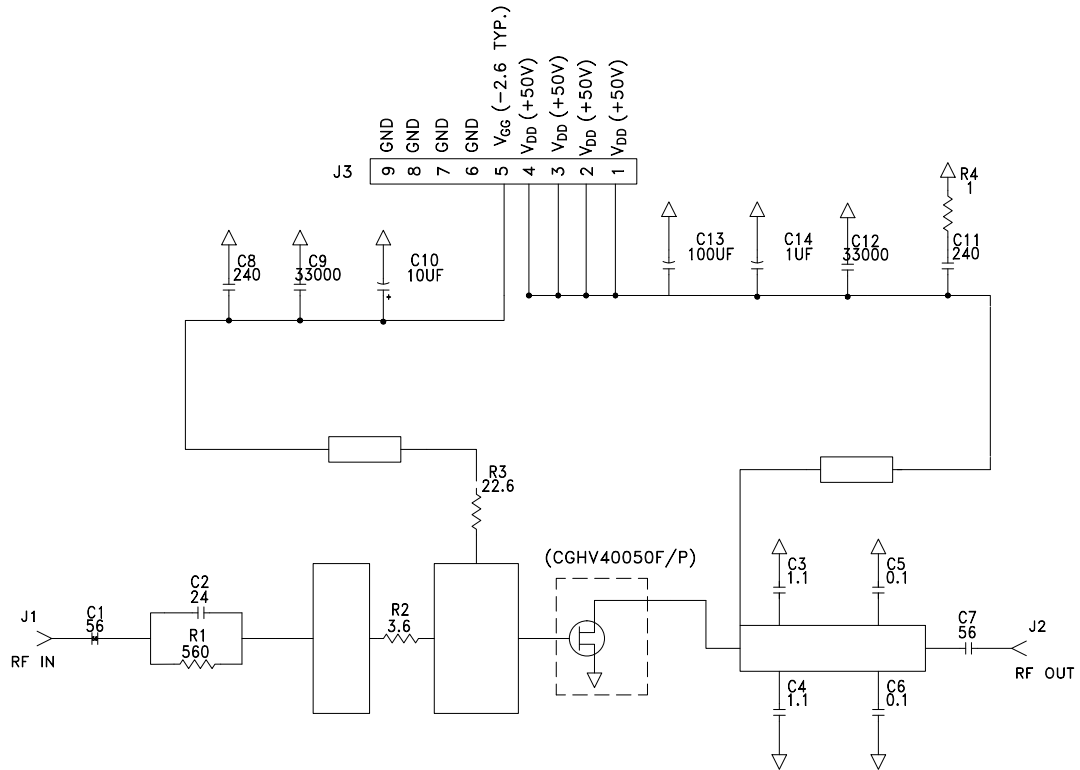
## Source and Load Impedances



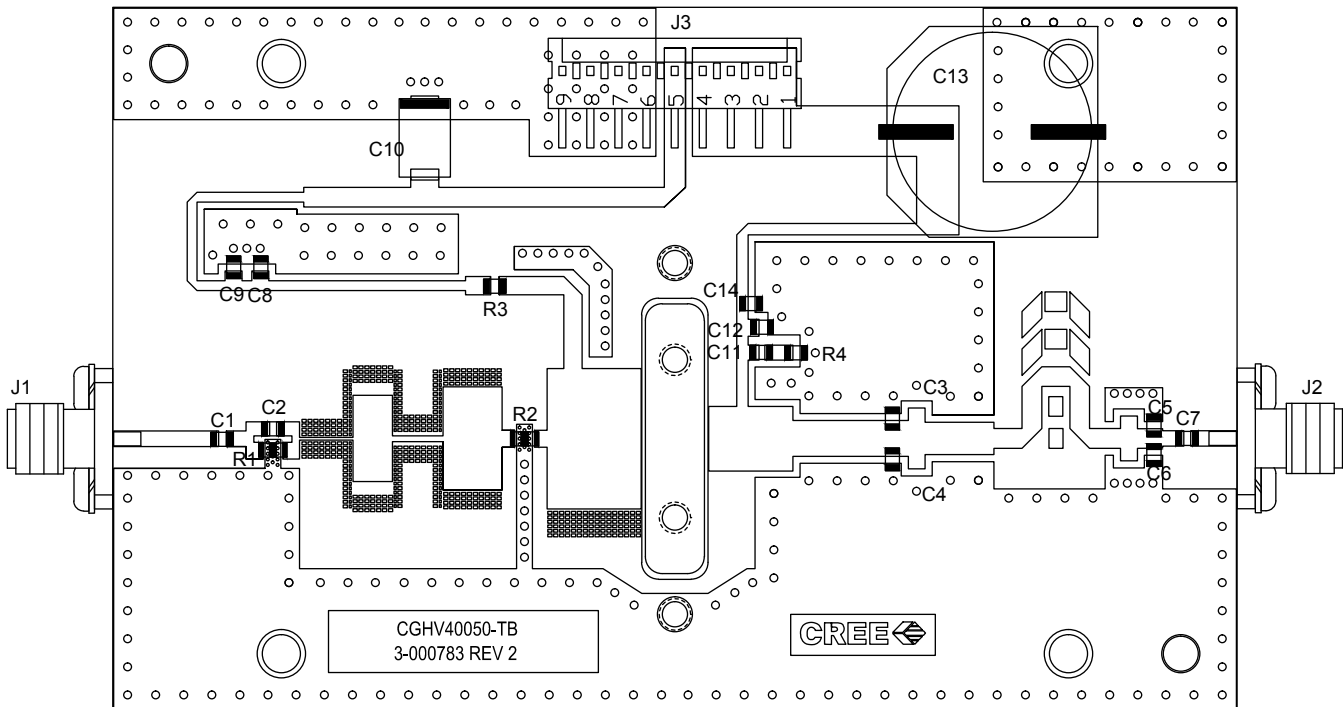
Frequency (MHz)	Z Source	Z Load
500	5.69+j7.82	21.47+j10.28
1000	3.21+j3.48	11.72+j10.50
2000	3.2-j1.74	3.84+j7.07
3000	3.23-j5.23	5.58+j3.02
4000	2.75-j10.6	4.65-j0.74

Note<sup>1</sup>:  $V_{DD} = 50\text{ V}, I_{DQ} = 300\text{ mA}$ . In the 440193 package.

## CGHV40050-TB Application Circuit Schematic



## CGHV40050-TB Application Circuit





## CGHV40050-TB Application Circuit Bill of Materials

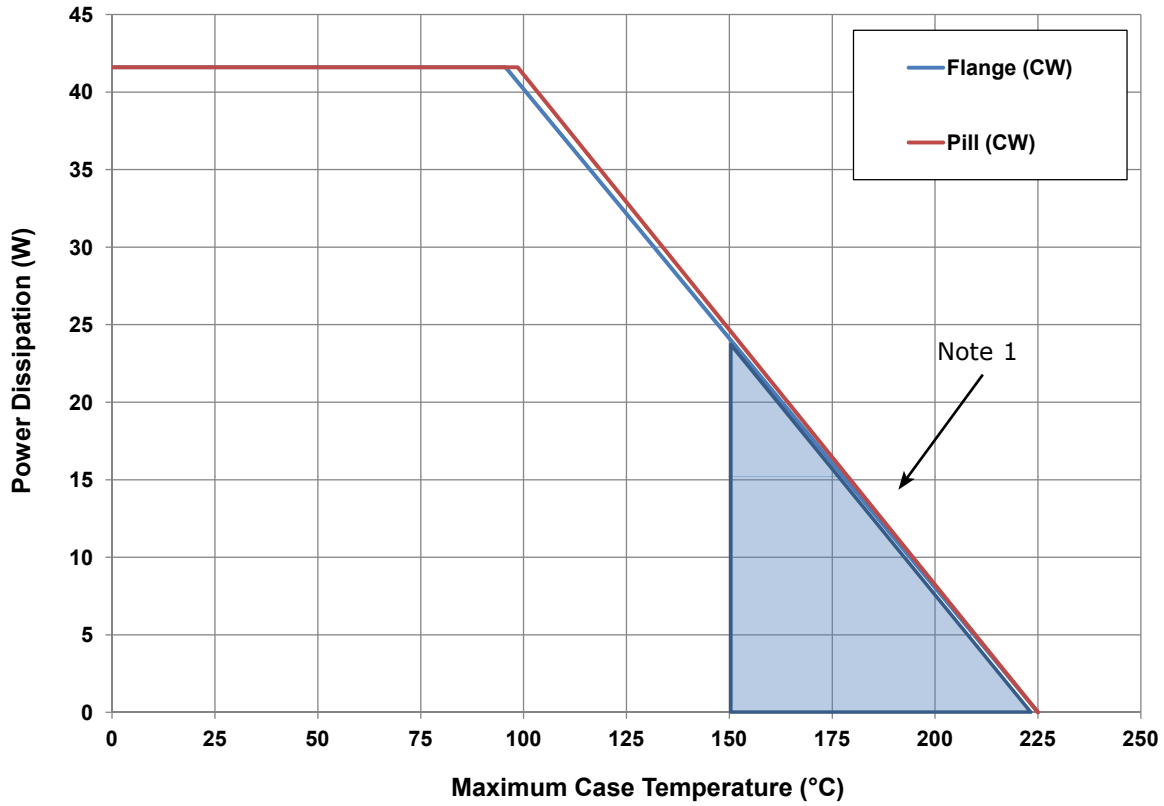
Designator	Description	Qty
R1	RES, 560Ohms,5%, 0805, HIGH POWER SMT, IMS	1
R2	RES, 3.60hms, 2%, 1005, HIGH POWER SMT, IMS	1
R3	RES, SMT, 0805, 22 OHM	1
R4	RES, SMT, 0805, 1OHM	1
C1, C7	CAP, 56 PF +/- 5%,, 250V, 0805, ATC 600F	3
C2	CAP, 10 pF +/- 5%, 250V, 0805, ATC 600F	1
C3, C4	CAP, 1.1pF, +/-0.1pF, 250V, 0805, ATC600F	2
C5, C6	CAP, 0.1 PF +/- 0.05 pF, 0805, ATC 600F	2
C8, C11	CAP, 240pF, +/-5%, 0805, ATC600F	2
C9, C12	CAP, 33000pF, 0805, 100V, X7R	2
C10	CAP, 10UF, 16V, TANTALUM	1
C13	CAP, 100UF, 80V, ELECTROLYTIC, CAN	1
C14	CAP, 1UF, 0805, 100V, X7S	1
J1,J2	CONN,N,FEM,W/.500 SMA FLNG	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
	BASEPLATE, CGH35120	1
	PCB, RO4350B, 2.5"x4"x0.020", CGHV40100F	1

## CGHV40050-TB Demonstration Amplifier Circuit



## CGHV40050 Power Dissipation De-rating Curve

Figure 4. - Transient Power Dissipation De-Rating Curve



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

## Electrostatic Discharge (ESD) Classifications

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



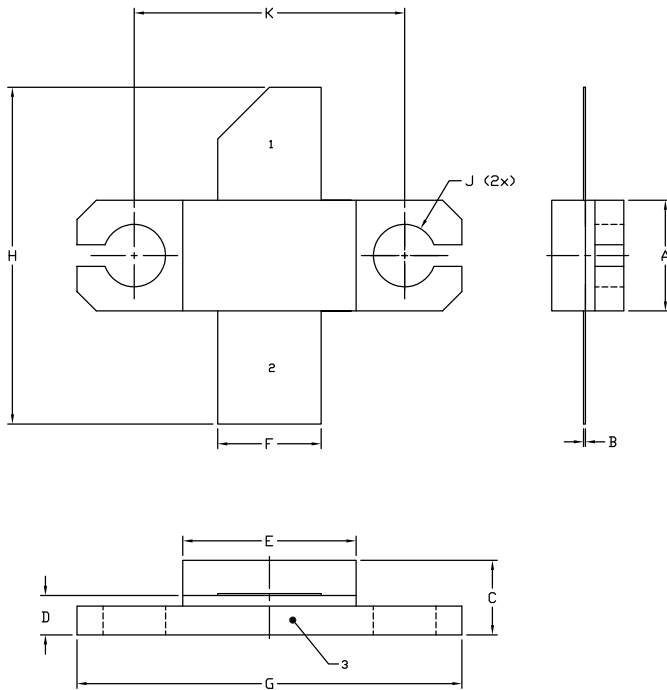
**Typical S-Parameters (Small Signal,  $V_{DS} = 50\text{ V}$ ,  $I_{DQ} = 300\text{ mA}$ , magnitude / angle)**

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.92	-161.97	13.79	79.27	0.01	-5.56	0.44	-142.42
600 MHz	0.92	-165.42	11.38	74.02	0.01	-9.73	0.46	-143.34
700 MHz	0.92	-168.02	9.62	69.31	0.01	-13.32	0.49	-144.16
800 MHz	0.93	-170.08	8.29	64.99	0.01	-16.49	0.52	-145.04
900 MHz	0.93	-171.8	7.24	60.98	0.009	-19.32	0.55	-146.01
1.0 GHz	0.93	-173.27	6.4	57.23	0.009	-21.83	0.58	-147.07
1.1 GHz	0.93	-174.58	5.7	53.71	0.009	-24.07	0.61	-148.21
1.2 GHz	0.94	-175.77	5.13	50.38	0.008	-26.05	0.63	-149.4
1.3 GHz	0.94	-176.86	4.64	47.24	0.008	-27.77	0.65	-150.62
1.4 GHz	0.94	-177.89	4.23	44.25	0.007	-29.25	0.67	-151.85
1.5 GHz	0.94	-178.87	3.87	41.42	0.007	-30.48	0.69	-153.09
1.6 GHz	0.94	-179.81	3.56	38.72	0.007	-31.46	0.71	-154.33
1.7 GHz	0.95	179.28	3.3	36.14	0.006	-32.19	0.73	-155.54
1.8 GHz	0.95	178.4	3.06	33.68	0.006	-32.66	0.74	-156.74
1.9 GHz	0.95	177.53	2.85	31.32	0.006	-32.85	0.76	-157.91
2.0 GHz	0.95	176.67	2.67	29.06	0.005	-32.75	0.77	-159.06
2.1 GHz	0.95	175.82	2.51	26.88	0.005	-32.33	0.78	-160.18
2.2 GHz	0.95	174.97	2.37	24.78	0.005	-31.57	0.79	-161.28
2.3 GHz	0.95	174.13	2.24	22.75	0.005	-30.43	0.8	-162.34
2.4 GHz	0.96	173.28	2.12	20.78	0.004	-28.87	0.81	-163.39
2.5 GHz	0.96	172.43	2.02	18.87	0.004	-26.86	0.82	-164.4
2.6 GHz	0.96	171.57	1.93	17.02	0.004	-24.35	0.82	-165.4
2.7 GHz	0.96	170.7	1.85	15.2	0.004	-21.31	0.83	-166.37
2.8 GHz	0.96	169.82	1.77	13.43	0.003	-17.72	0.84	-167.32
2.9 GHz	0.96	168.92	1.71	11.69	0.003	-13.6	0.84	-168.25
3.0 GHz	0.96	168.01	1.65	9.98	0.003	-8.98	0.85	-169.17
3.2 GHz	0.96	166.12	1.55	6.62	0.003	1.31	0.86	-170.95
3.4 GHz	0.96	164.13	1.47	3.33	0.003	11.88	0.86	-172.69
3.6 GHz	0.96	162	1.41	0.06	0.004	21.35	0.87	-174.4
3.8 GHz	0.95	159.72	1.36	-3.22	0.004	28.89	0.87	-176.09
4.0 GHz	0.95	157.25	1.33	-6.55	0.005	34.35	0.88	-177.76

To download the s-parameters in s2p format, go to the [CGHV40050 Product Page](#) and click on the documentation tab.



## Product Dimensions CGHV40050F (Package Type — 440193)

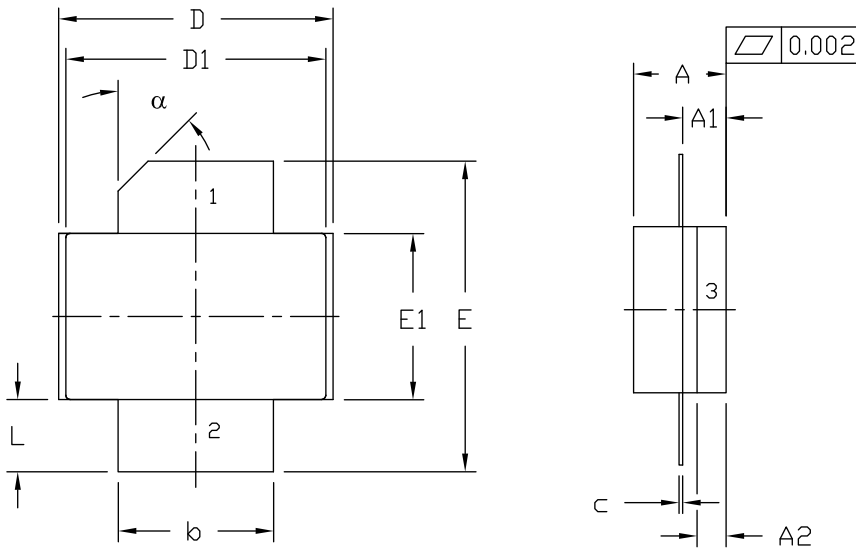


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
  4. LID MAY BE MISALIGNED TO THE BODY OF THE PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.
  5. ALL PLATED SURFACES ARE Ni/AU.

DIM	INCHES		MILLIMETERS	
	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	∅ .130		3.30	
k	0.562		14.28	

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

## Product Dimensions CGHV40050P (Package Type — 440206)



- 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	0.125	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  
 PIN 2. DRAIN  
 PIN 3. SOURCE



## Disclaimer

Specifications are subject to change without notice. Cree, Inc. believes the information contained within this data sheet to be accurate and reliable. However, no responsibility is assumed by Cree for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Cree. Cree makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose. "Typical" parameters are the average values expected by Cree in large quantities and are provided for information purposes only. These values can and do vary in different applications and actual performance can vary over time. All operating parameters should be validated by customer's technical experts for each application. Cree products are not designed, intended or authorized for use as components in applications intended for surgical implant into the body or to support or sustain life, in applications in which the failure of the Cree product could result in personal injury or death or in applications for planning, construction, maintenance or direct operation of a nuclear facility.

For more information, please contact:

Cree, Inc.  
4600 Silicon Drive  
Durham, North Carolina, USA 27703  
[www.cree.com/wireless](http://www.cree.com/wireless)

Sarah Miller  
Marketing & Export  
Cree, RF Components  
1.919.407.5302

Ryan Baker  
Marketing  
Cree, RF Components  
1.919.407.7816

Tom Dekker  
Sales Director  
Cree, RF Components  
1.919.407.5639

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



Тел: +7 (812) 336 43 04 (многоканальный)

Email: [org@lifeelectronics.ru](mailto:org@lifeelectronics.ru)