

# CGHV40030

**30 W, DC - 6 GHz, 50V, GaN HEMT**

Cree's CGHV40030 is an unmatched, gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically for high efficiency, high gain and wide bandwidth capabilities. The device can be deployed for L, S and C-Band amplifier applications. The datasheet specifications are based on a 0.96 - 1.4 GHz amplifier. The CGHV40030 operates on a 50 volt rail circuit while housed in a 2-lead flange or pill package.



Package Type: 440166 and 440196  
PN: CGHV40030

## Typical Performance 0.96 - 1.4 GHz ( $T_c = 25^\circ\text{C}$ ), 50 V

Parameter	0.96 GHz	1.1 GHz	1.25 GHz	1.4 GHz	Units
Gain @ $P_{SAT}$	15.6	15.8	16.6	15.8	dB
Saturated Output Power	29	30	36	31	W
Drain Efficiency @ $P_{SAT}$	62	74	64	67	%

Note:  
Measured CW in the CGHV40030-TB1 application circuit.

## Features

- Up to 6 GHz Operation
- 30 W Typical Output Power
- 16 dB Gain at 1.2 GHz
- Application circuit for 0.96 - 1.4 GHz
- 70% Efficiency at  $P_{SAT}$
- 50 V Operation

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

Parameter	Symbol	Rating	Units	Notes
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	$I_{GMAX}$	5.2	mA	25 °C
Maximum Drain Current <sup>1</sup>	$I_{DMAX}$	4.2	A	25 °C
Soldering Temperature <sup>2</sup>	$T_S$	245	°C	
Case Operating Temperature <sup>3,4</sup>	$T_C$	-40, +150	°C	
Thermal Resistance, Junction to Case <sup>5</sup>	$R_{JC}$	5.9	°C/W	85 °C

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/rf/document-library](http://www.cree.com/rf/document-library)

<sup>3</sup> Simulated at  $P_{DISS} = 23.4$  W

<sup>4</sup>  $T_C$  = Case temperature for the device. It refers to the temperature at the ground tab underneath the package. The PCB will add additional thermal resistance.

<sup>5</sup> CW

## Electrical Characteristics ( $T_C = 25$ °C) - 50 V Typical

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, $I_D = 5.2$ mA
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.6	-	$V_{DC}$	$V_{DS} = 50$ V, $I_D = 150$ mA
Saturated Drain Current <sup>2</sup>	$I_{DS}$	4.2	5.2	-	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	100	-	-	$V_{DC}$	$V_{GS} = -8$ V, $I_D = 5.2$ mA
<b>RF Characteristics<sup>3</sup> (<math>T_C = 25</math> °C, <math>F_0 = 1.2</math> GHz unless otherwise noted)</b>						
Power Gain	$G_p$	-	16	-	dB	$V_{DD} = 50$ V, $I_{DQ} = 150$ mA, $P_{OUT} = P_{SAT}$
Output Power <sup>4</sup>	$P_{OUT}$	-	30	-	W	$V_{DD} = 50$ V, $I_{DQ} = 150$ mA, $P_{OUT} = P_{SAT}$
Drain Efficiency <sup>4</sup>	$\eta$	-	65	-	%	$V_{DD} = 50$ V, $I_{DQ} = 150$ mA, $P_{OUT} = P_{SAT}$
Output Mismatch Stress <sup>4</sup>	VSWR	-	-	10 : 1	$\Psi$	No damage at all phase angles, $V_{DD} = 50$ V, $I_{DQ} = 150$ mA, $P_{OUT} = 30$ W CW
<b>Dynamic Characteristics</b>						
Input Capacitance <sup>5</sup>	$C_{GS}$	-	7.4	-	pF	$V_{DS} = 50$ V, $V_{gs} = -8$ V, $f = 1$ MHz
Output Capacitance <sup>5</sup>	$C_{DS}$	-	2	-	pF	$V_{DS} = 50$ V, $V_{gs} = -8$ V, $f = 1$ MHz
Feedback Capacitance	$C_{GD}$	-	0.15	-	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

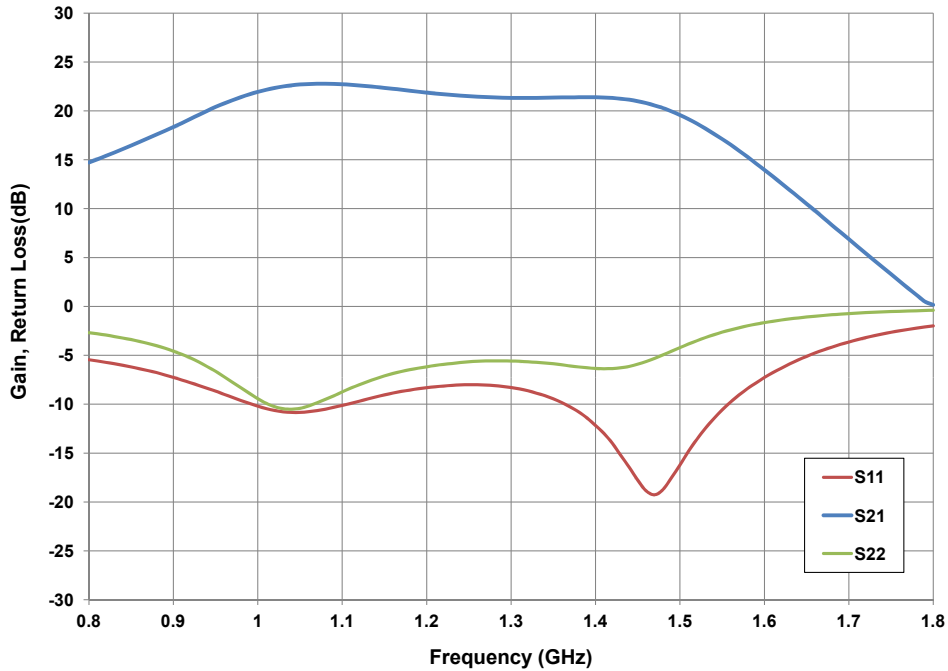
<sup>3</sup> Measured in CGHV40030-TB

<sup>4</sup>  $P_{SAT}$  is defined as  $I_G = 0.52$  mA

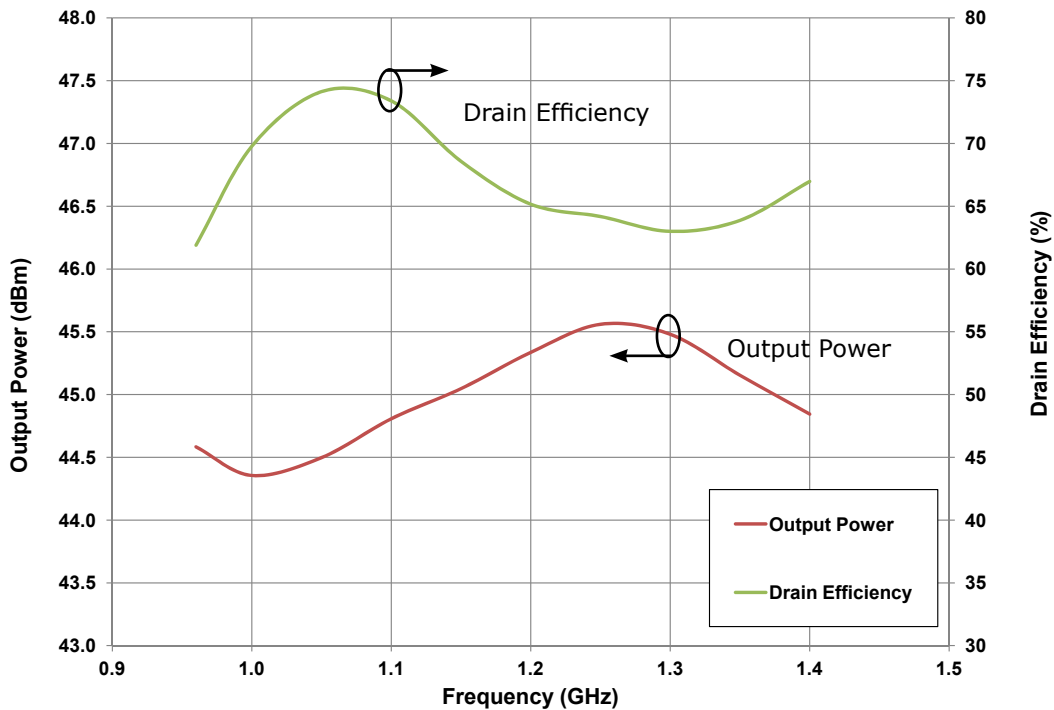
<sup>5</sup> Includes package

## Typical Performance

**Figure 1. - Typical Small Signal Response of CGHV40030-TB1 Application Circuit**  
 $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 150\text{ mA}$



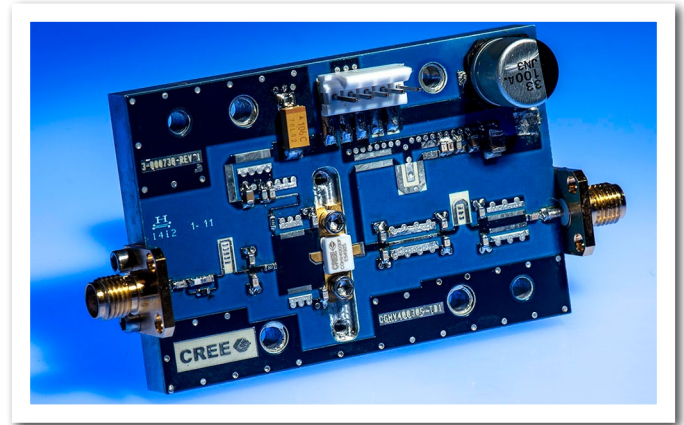
**Figure 2. - Typical Large Signal Response of CGHV40030-TB1 Application Circuit**  
 $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 150\text{ mA}$ ,  $P_{IN} = 29\text{ dBm}$ ,  $T_{CASE} = 25^\circ\text{C}$ , CW



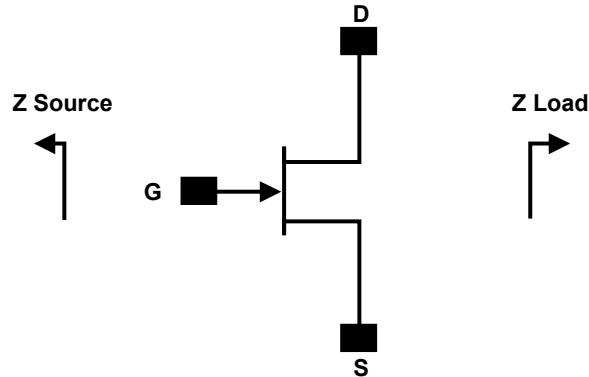
## CGHV40030-TB1 Application Circuit Bill of Materials

Designator	Description	Qty
R1	RES,1/16W,0603,1%,187 OHMS	1
R2	RES, 2.2 OHMS, +/- 1%, 1/16W,0603	1
R3	RES,1/16W,0603,1%,15.4 OHMS	1
L1	IND, 5.6nH, 0603	1
C3, C4	CAP, 2.7,+/-0.1pF, 0603, ATC	2
C5, C6, C11, C12	CAP, 1.2pF,+/-0.1pF, 0603, ATC	4
C2, C7, C8	CAP 1.8pF,+/-0.1pF 0603, ATC	2
C9, C10	CAP, 3.9pF,+/-0.1pF 0603, ATC	2
C1, C13	CAP, 24pF,+/-5% 0603, ATC	2
C14	CAP 10UF 16V TANTALUM	1
C15, C20	CAP, 33000pF, 0805, ATC	2
C16,C21	CAP, 470PF, 5%, 100V, 0603,	2
C17	CAP, 68pF,+/-0.1pF 0603, ATC	1
C22	CAP, 56PF +/- 5%, 0603 , ATC600S	1
C18	CAP, 33UF, 20%, G CASE	1
C19	CAP, 1.0UF, 100V, 10%, X7R, 1210	1
J1,J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST	2
J3	HEADER RT>PLZ .1CEN LK 5POS	1
	BASEPLATE, CGH35015, 2.60 X 1.7	1
	CGHV40030F/P PCB, RO4350, 0.020" THK	1

## CGHV40030-TB1 Application Circuit



## Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
500	5.5 + j0.9	43 + j20.8
1000	2.6 - j1.3	25.5 + j29.1
2000	3.8 - j0.9	11.5 + j17.3
3000	2.7 - j7.0	6.7 + j7.8
4000	2.8 - j13.4	6.5 + j1.7

Note<sup>1</sup>:  $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 150\text{ mA}$

Note<sup>2</sup>: Impedances are extracted from source and load pull data derived from the transistor.

## Electrostatic Discharge (ESD) Classifications

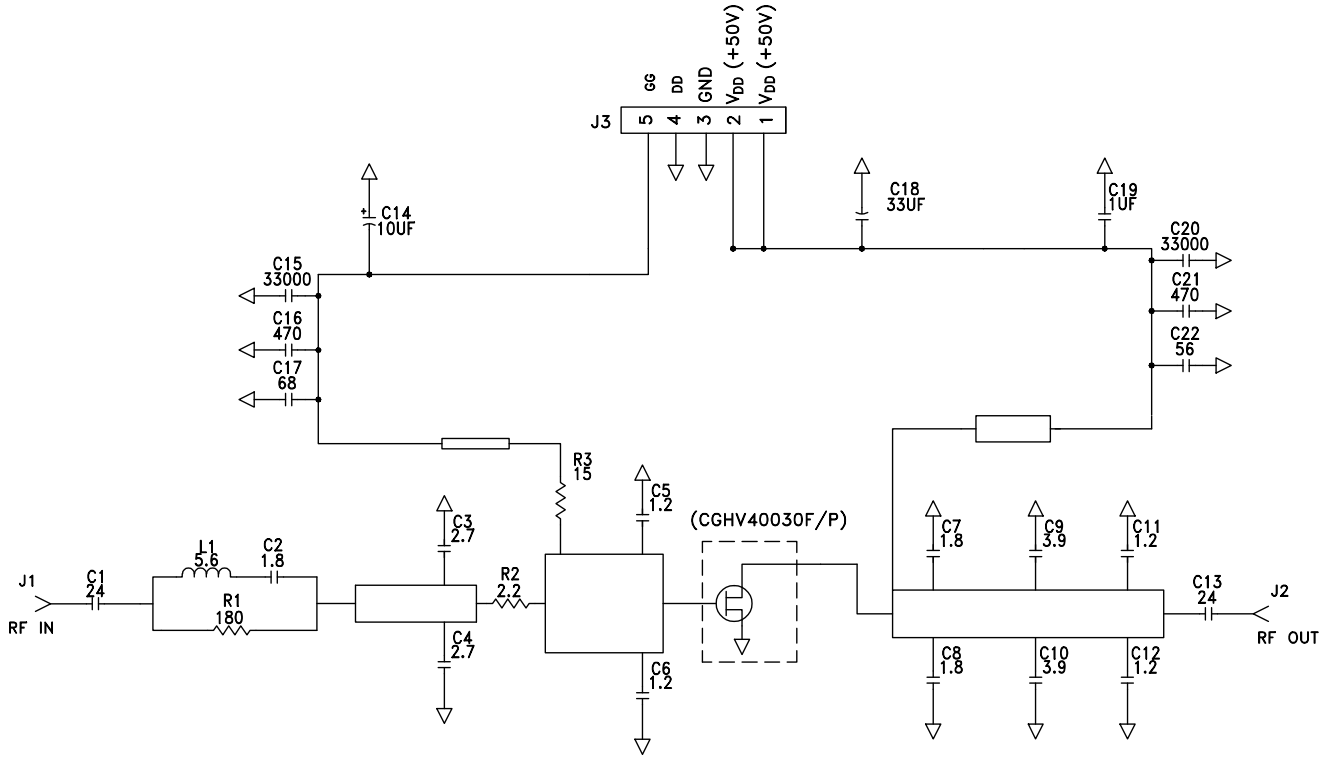
Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (200 < 500 V)	JEDEC JESD22 C101-C

## Typical Package S-Parameters for CGHV40030 (Small Signal, $V_{DS} = 50\text{ V}$ , $I_{DQ} = 0.52\text{ mA}$ , angle in degrees)

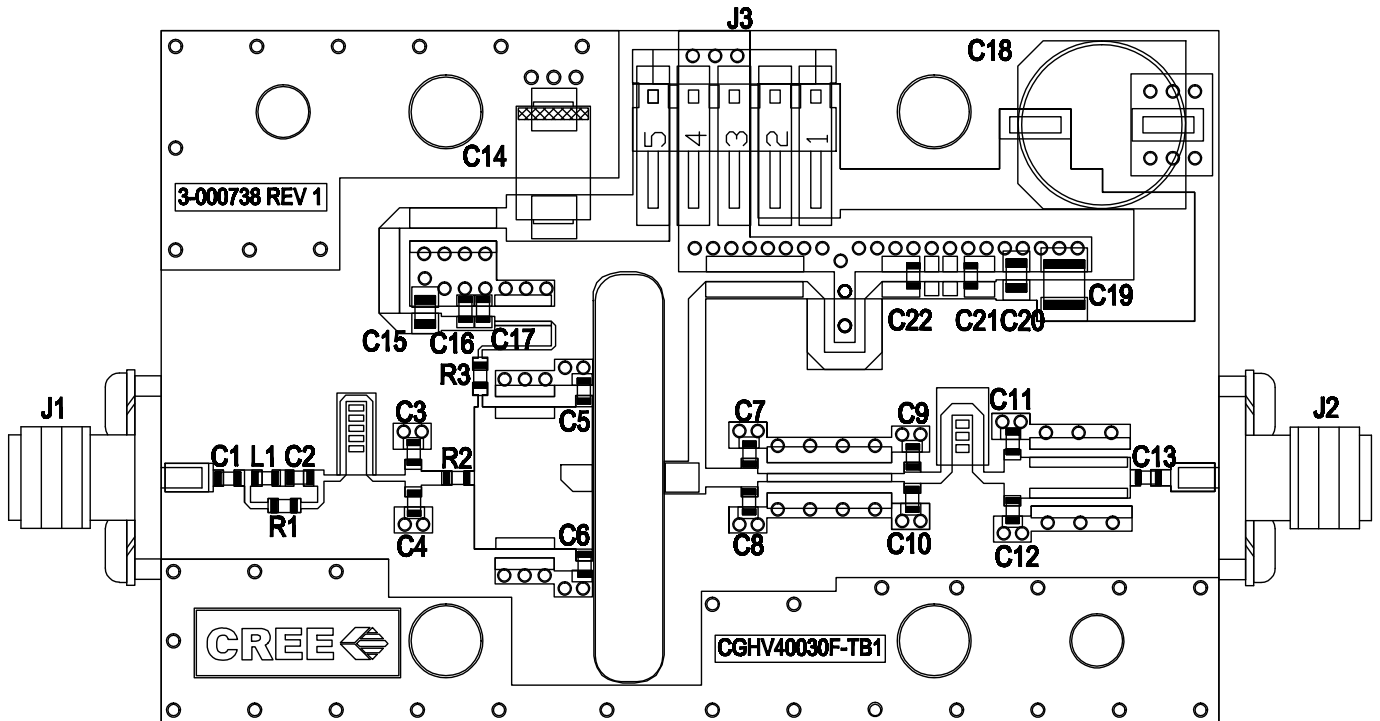
Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.92	-135.45	21.23	101.31	0.01	16.50	0.32	-74.10
600 MHz	0.92	-143.51	18.06	95.44	0.01	11.72	0.32	-79.66
700 MHz	0.91	-149.71	15.66	90.50	0.01	7.89	0.31	-84.44
800 MHz	0.91	-154.67	13.78	86.16	0.01	4.69	0.32	-88.69
900 MHz	0.91	-158.75	12.27	82.26	0.01	1.97	0.33	-92.58
1.0 GHz	0.91	-162.21	11.04	78.67	0.01	-0.41	0.34	-96.19
1.1 GHz	0.91	-165.20	10.02	75.32	0.01	-2.50	0.35	-99.57
1.2 GHz	0.91	-167.83	9.15	72.16	0.01	-4.34	0.36	-102.79
1.3 GHz	0.91	-170.19	8.41	69.14	0.01	-5.98	0.37	-105.86
1.4 GHz	0.92	-172.34	7.76	66.24	0.01	-7.43	0.39	-108.80
1.5 GHz	0.92	-174.30	7.20	63.45	0.01	-8.69	0.40	-111.64
1.6 GHz	0.92	-176.13	6.70	60.74	0.01	-9.77	0.42	-114.39
1.7 GHz	0.92	-177.83	6.26	58.11	0.01	-10.67	0.43	-117.06
1.8 GHz	0.92	-179.44	5.86	55.54	0.01	-11.39	0.45	-119.65
1.9 GHz	0.92	179.04	5.50	53.03	0.01	-11.90	0.46	-122.18
2.0 GHz	0.92	177.58	5.18	50.58	0.01	-12.20	0.48	-124.64
2.1 GHz	0.92	176.19	4.89	48.17	0.01	-12.26	0.49	-127.05
2.2 GHz	0.92	174.84	4.62	45.81	0.01	-12.07	0.51	-129.41
2.3 GHz	0.93	173.54	4.37	43.50	0.01	-11.60	0.52	-131.72
2.4 GHz	0.93	172.28	4.14	41.22	0.01	-10.82	0.53	-133.98
2.5 GHz	0.93	171.06	3.93	38.98	0.01	-9.70	0.55	-136.21
2.6 GHz	0.93	169.86	3.73	36.78	0.01	-8.20	0.56	-138.39
2.7 GHz	0.93	168.70	3.55	34.62	0.01	-6.30	0.57	-140.53
2.8 GHz	0.93	167.55	3.38	32.49	0.01	-3.97	0.59	-142.63
2.9 GHz	0.93	166.43	3.23	30.39	0.01	-1.18	0.60	-144.70
3.0 GHz	0.94	165.33	3.08	28.33	0.01	2.04	0.61	-146.73
3.2 GHz	0.94	163.18	2.81	24.29	0.01	9.69	0.64	-150.70
3.4 GHz	0.94	161.08	2.57	20.36	0.01	18.36	0.66	-154.54
3.6 GHz	0.94	159.05	2.36	16.55	0.01	27.05	0.68	-158.26
3.8 GHz	0.95	157.05	2.17	12.85	0.01	34.79	0.70	-161.87
4.0 GHz	0.95	155.10	2.00	9.25	0.01	41.04	0.72	-165.37
4.2 GHz	0.95	153.19	1.85	5.75	0.01	45.73	0.73	-168.77
4.4 GHz	0.95	151.31	1.72	2.35	0.01	49.02	0.75	-172.07
4.6 GHz	0.96	149.46	1.59	-0.96	0.01	51.19	0.76	-175.28
4.8 GHz	0.96	147.65	1.48	-4.18	0.01	52.48	0.78	-178.39
5.0 GHz	0.96	145.86	1.37	-7.31	0.01	53.11	0.79	178.58
5.2 GHz	0.96	144.11	1.28	-10.36	0.01	53.24	0.80	175.63
5.4 GHz	0.96	142.38	1.19	-13.33	0.01	52.98	0.82	172.76
5.6 GHz	0.96	140.68	1.11	-16.22	0.02	52.43	0.83	169.97
5.8 GHz	0.97	139.00	1.04	-19.03	0.02	51.65	0.84	167.25
6.0 GHz	0.97	137.35	0.98	-21.76	0.02	50.70	0.85	164.60

To download the s-parameters in s2p format, go to the CGHV40030 Product Page and click on the documentation tab.

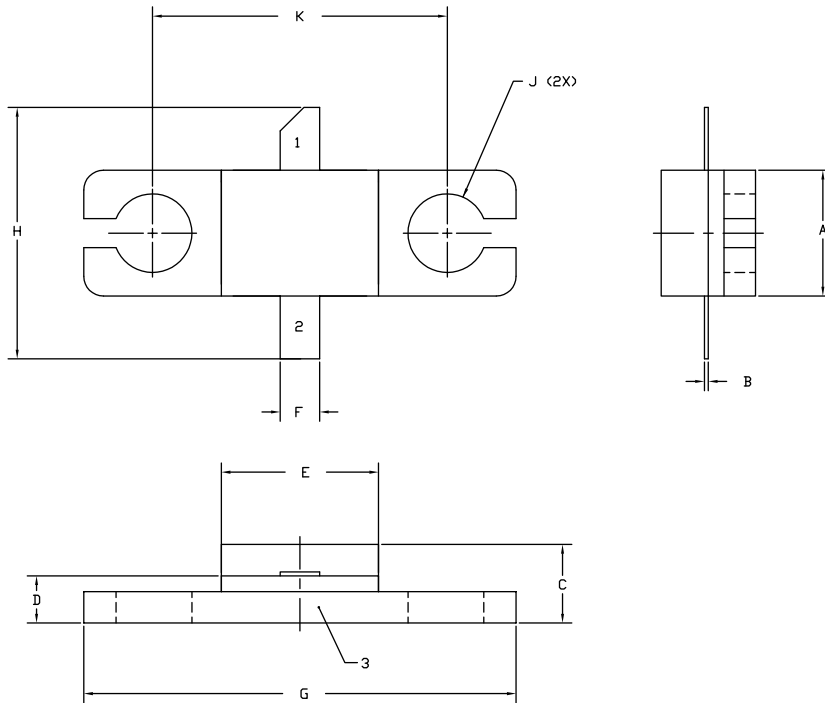
## CGHV40030-TB1 Application Circuit Schematic



## CGHV40030-TB1 Application Circuit Outline



## Product Dimensions CGHV40030F (Package Type - 440166 )



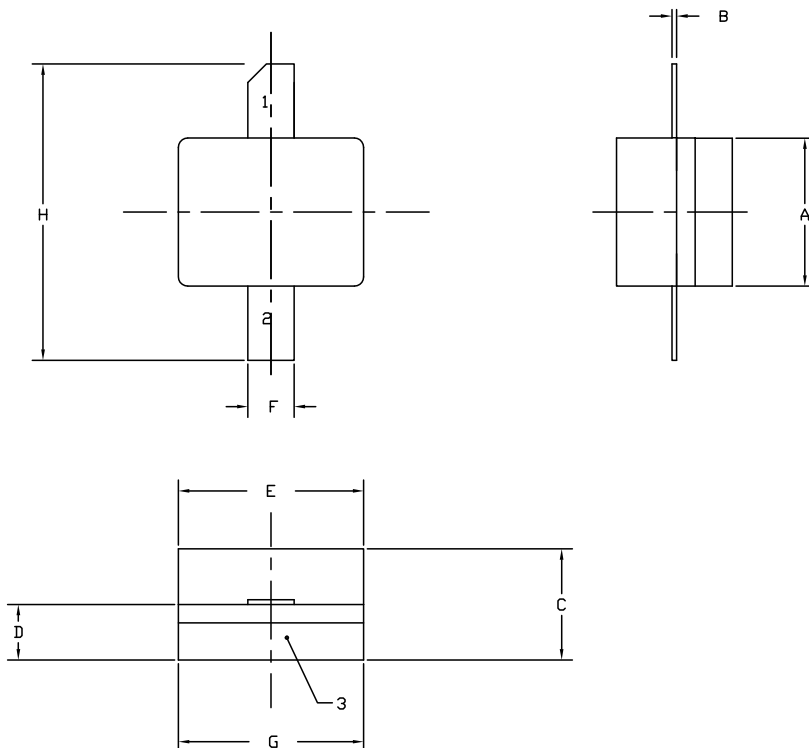
**NOTES:**

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	0.155	0.165	3.94	4.19
B	0.004	0.006	0.10	0.15
C	0.115	0.135	2.92	3.43
D	0.057	0.067	1.45	1.70
E	0.195	0.205	4.95	5.21
F	0.045	0.055	1.14	1.40
G	0.545	0.555	13.84	14.09
H	0.280	0.360	7.11	9.14
J	Ø .100		2.54	
K	0.375		9.53	

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

## Product Dimensions CGHV40030P (Package Type - 440196)



**NOTES:**

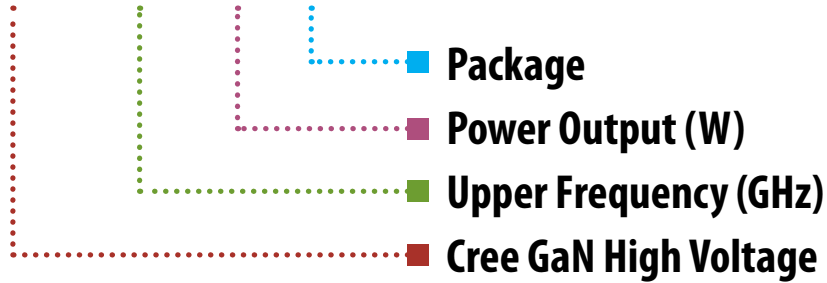
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DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.155	0.165	3.94	4.19
B	0.003	0.006	0.10	0.15
C	0.115	0.135	2.92	3.17
D	0.057	0.067	1.45	1.70
E	0.195	0.205	4.95	5.21
F	0.045	0.055	1.14	1.40
G	0.195	0.205	4.95	5.21
H	0.280	0.360	7.11	9.14

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



### CGHV40030F/P



Parameter	Value	Units
Upper Frequency <sup>1</sup>	6	GHz
Power Output	30	W
Package	Flanged/Pill	-

**Table 1.**

**Note<sup>1</sup>:** 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.**

## Disclaimer

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