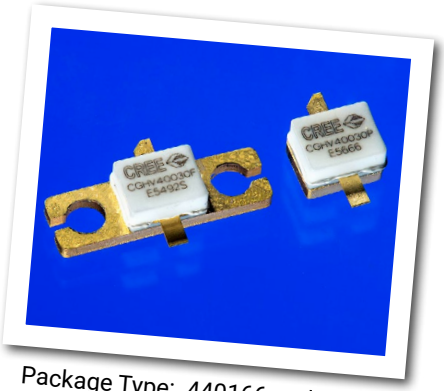
CGHV40030

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°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-AMP application circuit.

Features

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

Large Signal Models Available for ADS and MWO

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[1]	I_{DMAX}	4.2	A	25˚C
Soldering Temperature[2]	T_S	245	˚C	
Case Operating Temperature[3]	T_C	-40, +85	˚C	
Thermal Resistance, Junction to Case[4]	$R_{\theta JC}$	5.9	˚C/W	85˚C

Note:
[1] Current limit for long term, reliable operation
[2] Refer to the Application Note on soldering at www.cree.com/rf/document-library
[3] P_{DISS} = 23.4 W
[4] CW

Electrical Characteristics (T_C = 25˚C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1]						
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[2]	I_{DS}	3.9	5.2	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	125	–	–	V_{DC}	V_{GS} = -8 V, I_D = 5.2 mA
RF Characteristics[3] (T_C = 25˚C, F_0 = 1.2 GHz unless otherwise noted)						
Power Gain[4]	G_P	15	16	-	dB	V_{DD} = 50 V, I_{DQ} = 150 mA, P_{OUT} = P_{SAT}
Output Power[4]	P_{OUT}	30	35	–	W	V_{DD} = 50 V, I_{DQ} = 150 mA, P_{OUT} = P_{SAT}
Drain Efficiency[4]	η	62	65	-	%	V_{DD} = 50 V, I_{DQ} = 150 mA, P_{OUT} = P_{SAT}
Output Mismatch Stress[4]	VSWR	-	-	10 : 1	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 150 mA, P_{OUT} = 30 W CW
Dynamic Characteristics						
Input Capacitance[5]	C_{GS}	–	7.4	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance[5]	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:
[1] Measured on wafer prior to packaging
[2] Scaled from PCM data
[3] Measured in CGHV40030-AMP
[4] P_{SAT} is defined as I_G = 0.52 mA
[5] Includes package

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Typical Performance

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

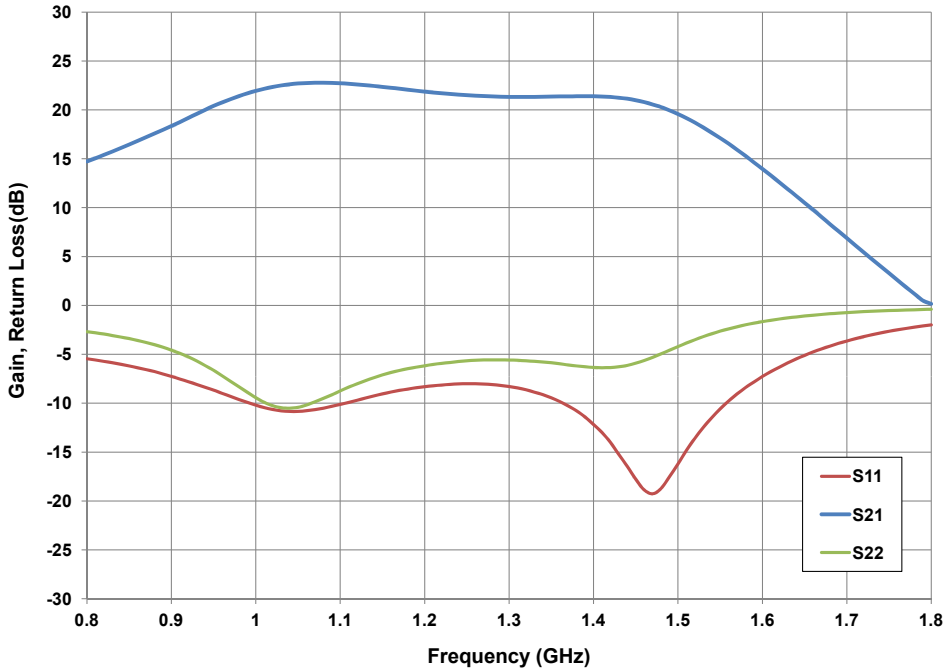
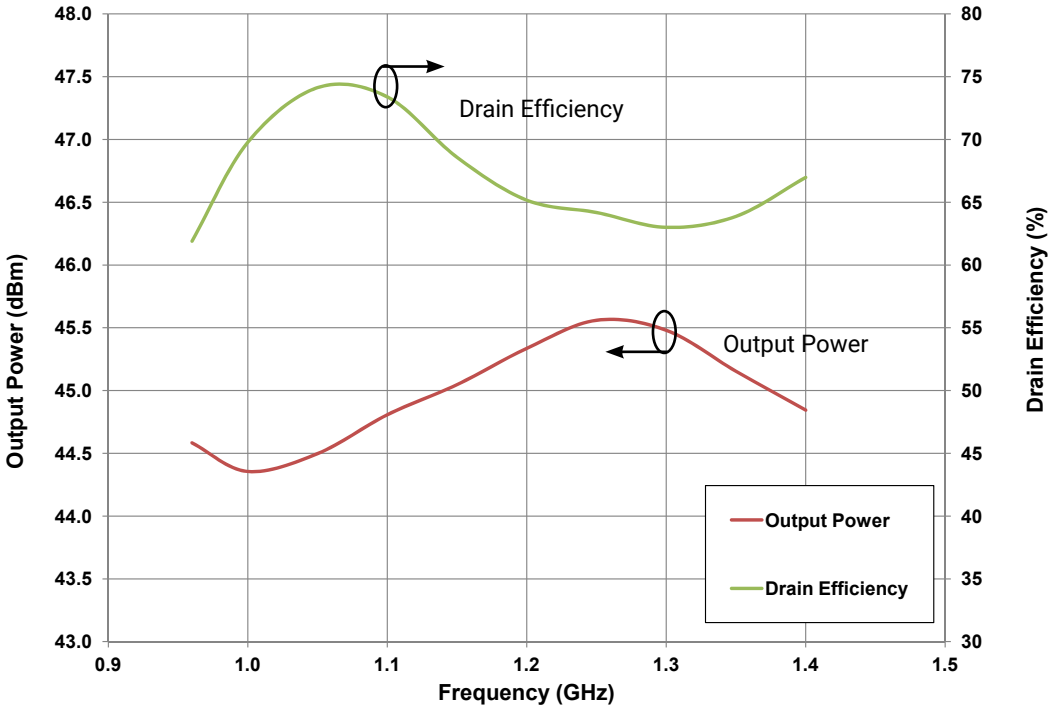


Figure 2. - Typical Large Signal Response of CGHV40030-AMP Application Circuit
V_{DD} = 50 V, I_{DQ} = 150 mA, P_{IN} = 29 dBm, T_{CASE} = 25°C, CW



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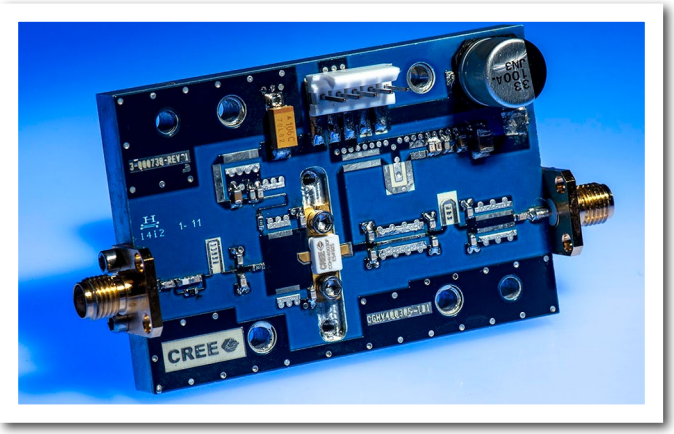
CGHV40030-AMP Application Circuit Bill of Materials

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
C11, C12	CAP, 1.2pF,+/-0.1pF, 0603, ATC	2
C5, C6	CAP, 0.8pF,+/-0.1pF, 0603, ATC	2
C2, C7, C8	CAP 1.8pF,+/-0.05pF 0603, ATC	3
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
	2-56 SOC HD SCREW 1/4 SS	4
	#2 SPLIT LOCKWASHER SS	4

CGHV40030-AMP Application Circuit



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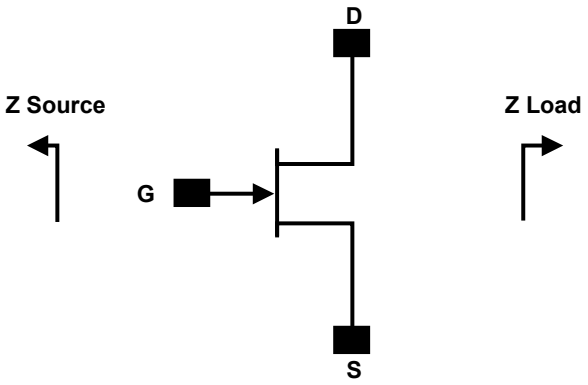
Source and Load Impedances



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[1]: V_{DD} = 50 V, I_{DQ} = 150 mA
Note[2]: 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

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Typical Package S-Parameters for CGHV40030
(Small Signal, V_{DS} = 50 V, I_{DQ} = 150 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.

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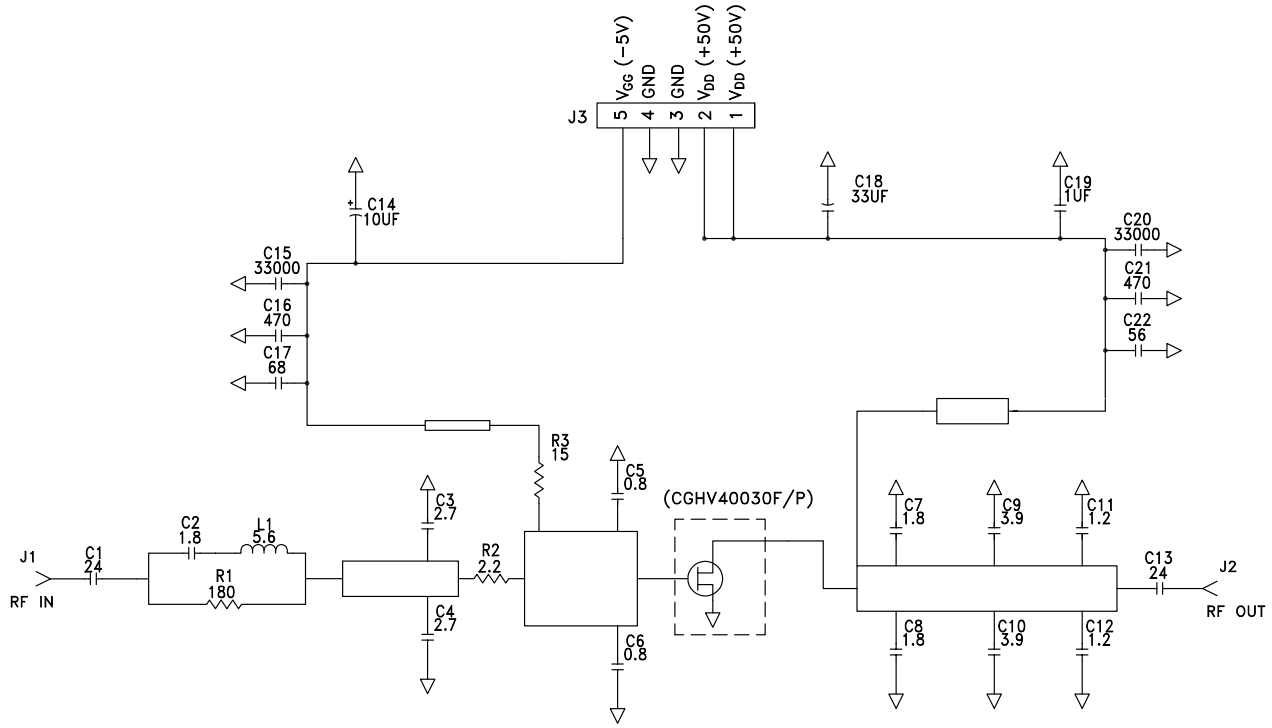
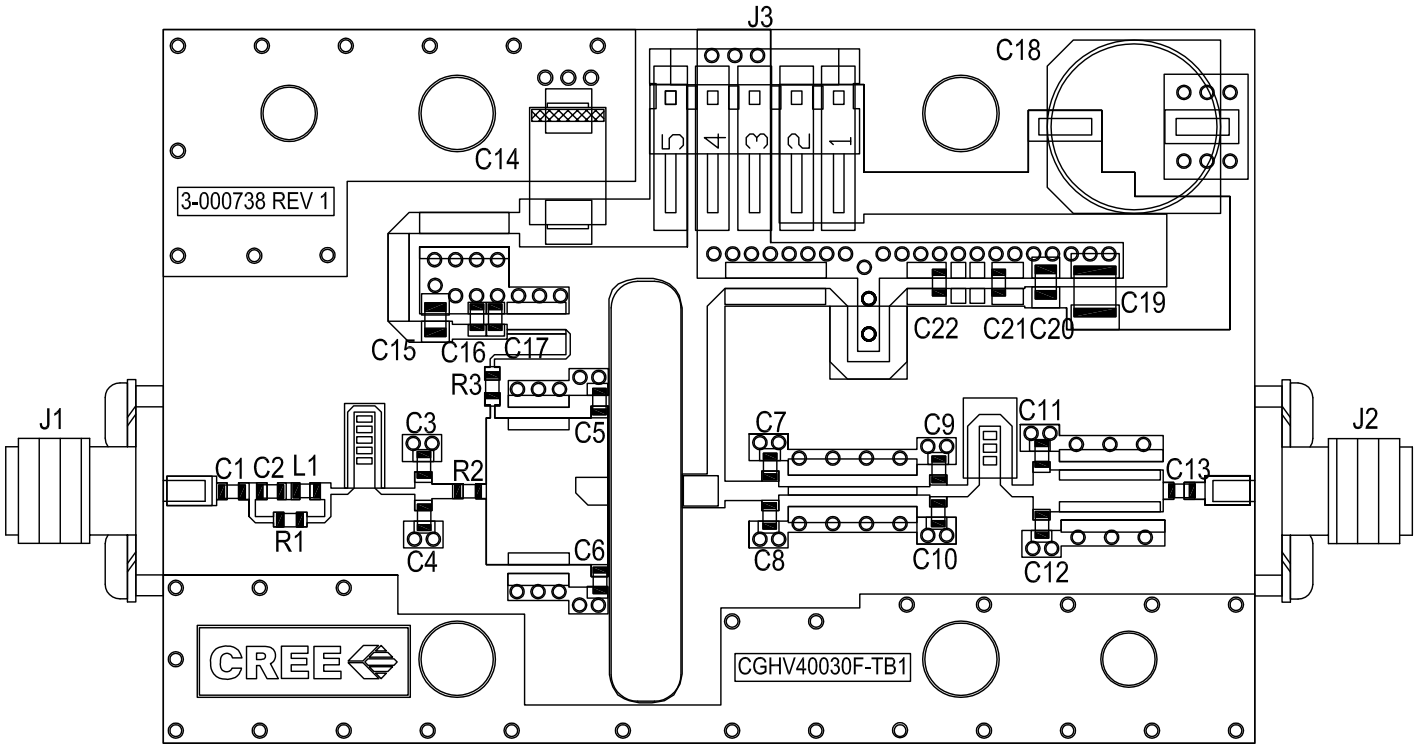
CGHV40030-AMP Application Circuit Schematic



CGHV40030-AMP Application Circuit Outline



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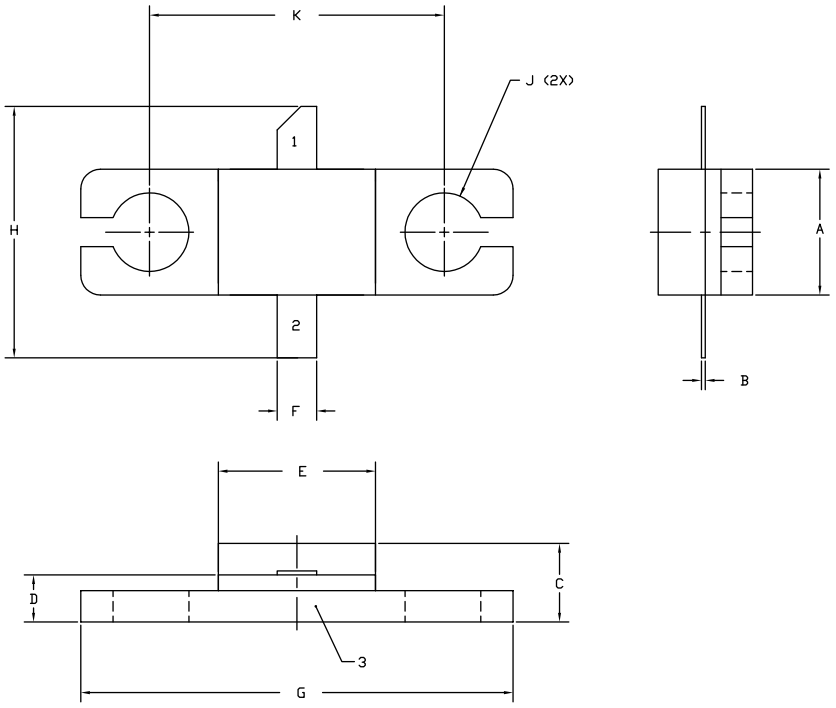
Product Dimensions CGHV40030F (Package Type - 440166)



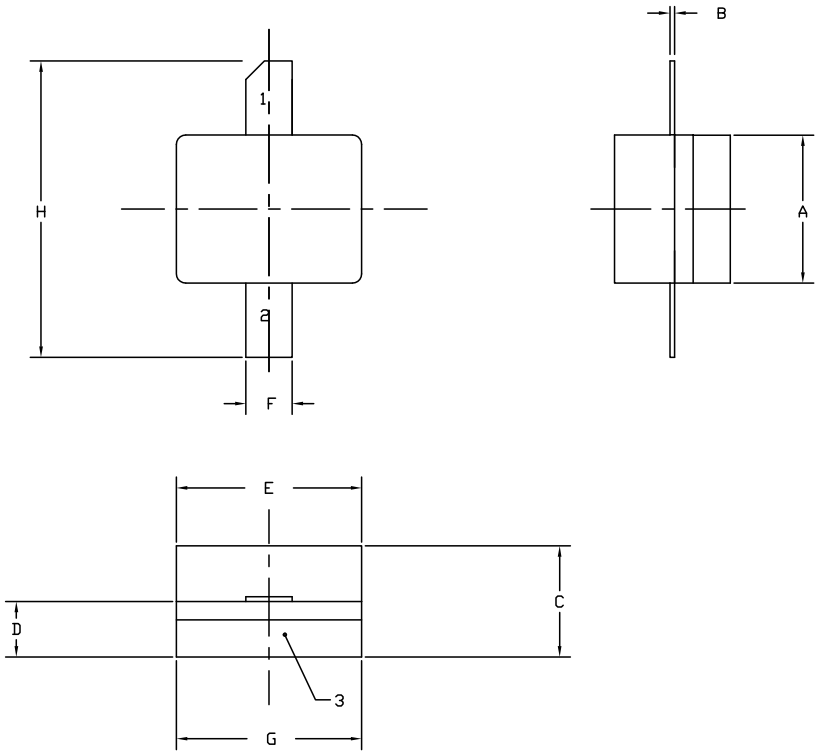
NOTES:

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

	INCHES		MILLIMETERS	
DIM	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)



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	INCHES		MILLIMETERS	
DIM	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

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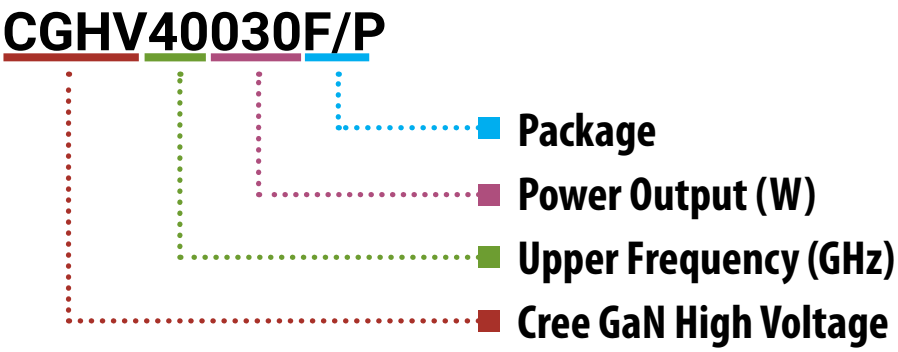
Part Number System



Parameter	Value	Units
Upper Frequency[1]	6	GHz
Power Output	30	W
Package	Flanged/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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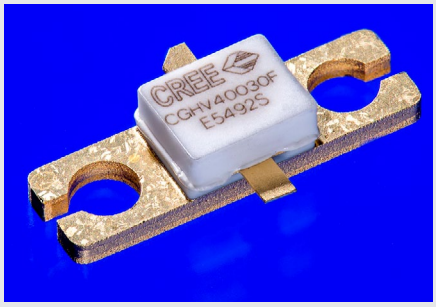
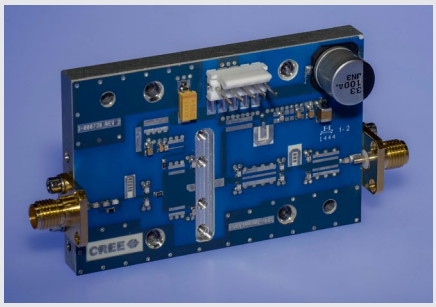
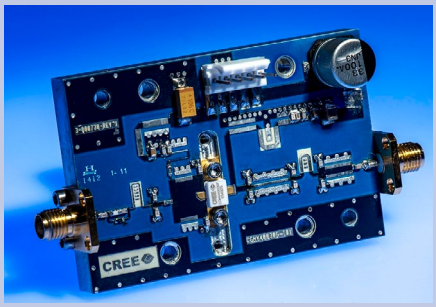
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV40030F	GaN HEMT	Each	
CGHV40030P	GaN HEMT	Each	
CGHV40030-TB	Test board without GaN HEMT	Each	
CGHV40030F-AMP	Test board with GaN HEMT installed	Each	

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