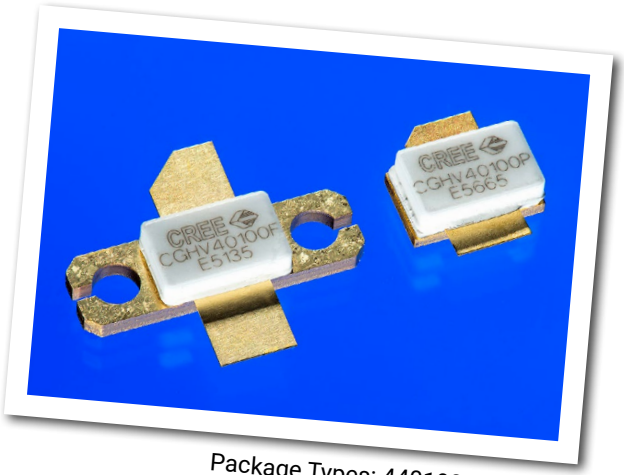
CGHV40100

100 W, DC - 3.0 GHz, 50 V, GaN HEMT

Cree's CGHV40100 is an unmatched, gallium nitride (GaN) high electron mobility transistor (HEMT). The CGHV40100, operating from a 50 volt rail, offers a general purpose, broadband solution to a variety of RF and microwave applications. GaN HEMTs offer high efficiency, high gain and wide bandwidth capabilities making the CGHV40100 ideal for linear and compressed amplifier circuits. The transistor is available in a 2-lead flange and pill package.



Package Types: 440193 & 440206
PN: CGHV40100F & CGHV40100P

Typical Performance Over 500 MHz - 2.5 GHz (T_c = 25°C), 50 V

Parameter	500 MHz	1.0 GHz	1.5 GHz	2.0 GHz	2.5 GHz	Units
Small Signal Gain	17.6	16.9	17.7	17.5	14.8	dB
Saturated Output Power	147	100	141	116	112	W
Drain Efficiency @ P_{SAT}	68	56	58	54	54	%
Input Return Loss	6	5.1	10.5	5.5	8.8	dB

Note:
Measured CW in the CGHV40100F-AMP application circuit.

Features

- Up to 3 GHz Operation
- 100 W Typical Output Power
- 17.5 dB Small Signal Gain at 2.0 GHz
- Application Circuit for 0.5 - 2.5 GHz
- 55 % Efficiency at P_{SAT}
- 50 V Operation

Large Signal Models Available for ADS and MWO

Rev 3.3 - February 2018

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

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}	20.8	mA	25˚C
Maximum Drain Current[1]	I_{DMAX}	8.7	A	25˚C
Soldering Temperature[2]	T_S	245	˚C	
Screw Torque	τ	40	in-oz	
Thermal Resistance, Junction to Case[3]	$R_{\theta JC}$	1.62	˚C/W	85˚C
Thermal Resistance, Junction to Case[4]	$R_{\theta JC}$	1.72	˚C/W	85˚C
Case Operating Temperature[5]	T_C	-40, +150	˚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] Measured for the CGHV40100P at P_{DISS} = 83 W.
[4] Measured for the CGHV40100F at P_{DISS} = 83 W.
[5] See also, Power Derating Curve on Page 5.

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 = 20.8 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	V_{DC}	V_{DS} = 50 V, I_D = 0.6 A
Saturated Drain Current[2]	I_{DS}	15.6	18.7	–	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 = 20.8 mA
RF Characteristics[3] (T_C = 25˚C, F_0 = 2.0 GHz unless otherwise noted)						
Small Signal Gain	G_{SS}	–	17.5	–	dB	V_{DD} = 50 V, I_{DQ} = 0.6 A
Power Gain	G_P	–	11.0	–	dB	V_{DD} = 50 V, I_{DQ} = 0.6 A, P_{OUT} = P_{SAT}
Power Output at Saturation[4]	P_{SAT}	–	116	–	W	V_{DD} = 50 V, I_{DQ} = 0.6 A
Drain Efficiency	η	–	54	–	%	V_{DD} = 50 V, I_{DQ} = 0.6 A, P_{OUT} = P_{SAT}
Output Mismatch Stress	VSWR	–	–	10 : 1	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 0.6 A, P_{OUT} = 100 W CW
Dynamic Characteristics[5]						
Input Capacitance	C_{GS}	–	29.3	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	7.3	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	0.61	–	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 CGHV40100-AMP
[4] P_{SAT} is defined as I_G = 0.208 mA.
[5] Includes package

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Figure 1. - Small Signal Gain and Return Losses versus Frequency measured in application circuit CGHV40100-AMP
V_{DD} = 50 V, I_{DQ} = 600 mA, Tcase = 25°C

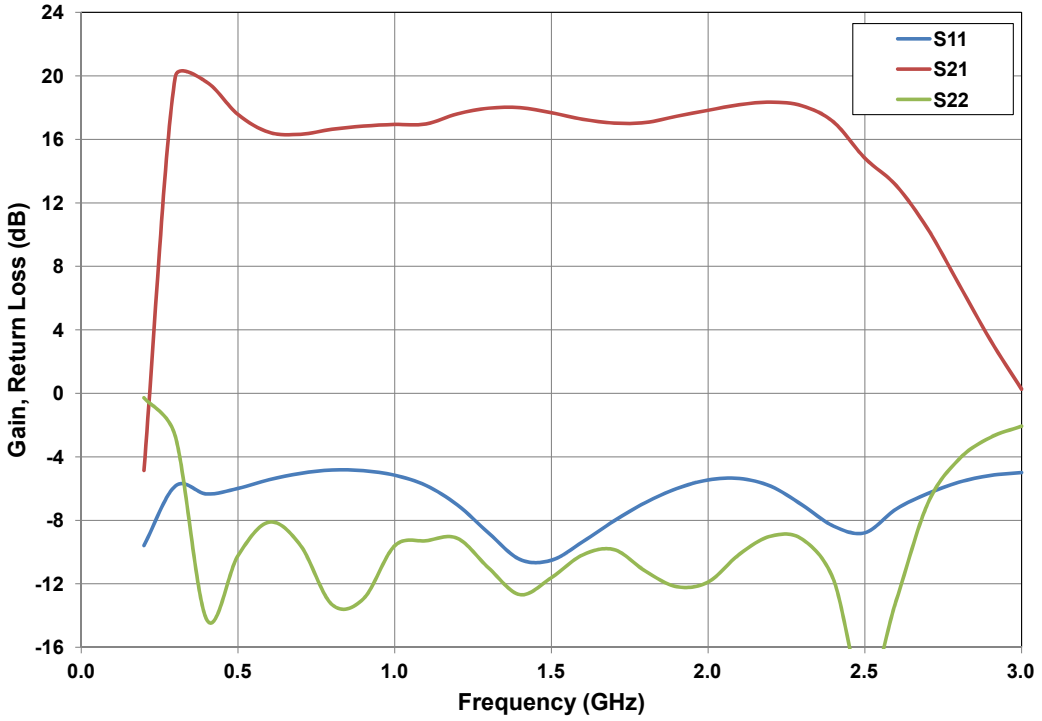

Figure 2. - Output Power and Drain Efficiency vs Frequency
V_{DD} = 50 V, I_{DQ} = 600 mA

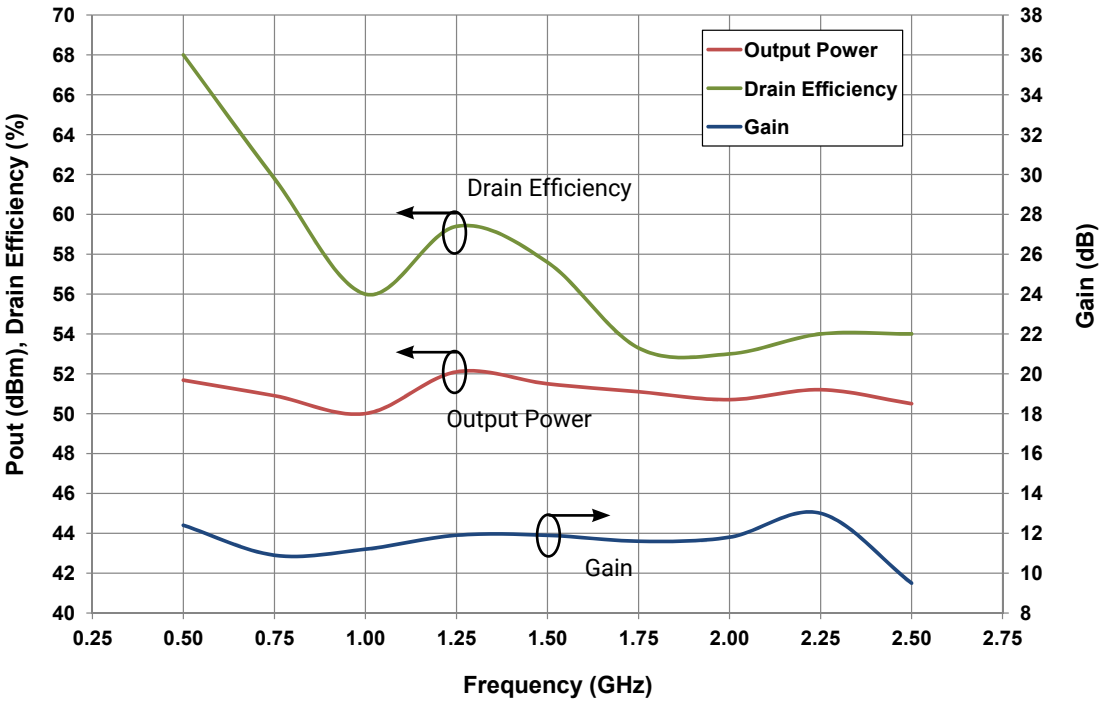

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Figure 3. - Third Order Intermodulation Distortion vs Average Output Power measured in Broadband Amplifier Circuit CGHV40100-AMP Spacing = 1 MHz, V_{DD} = 50 V, I_{DQ} = 600 mA, Tcase = 25°C

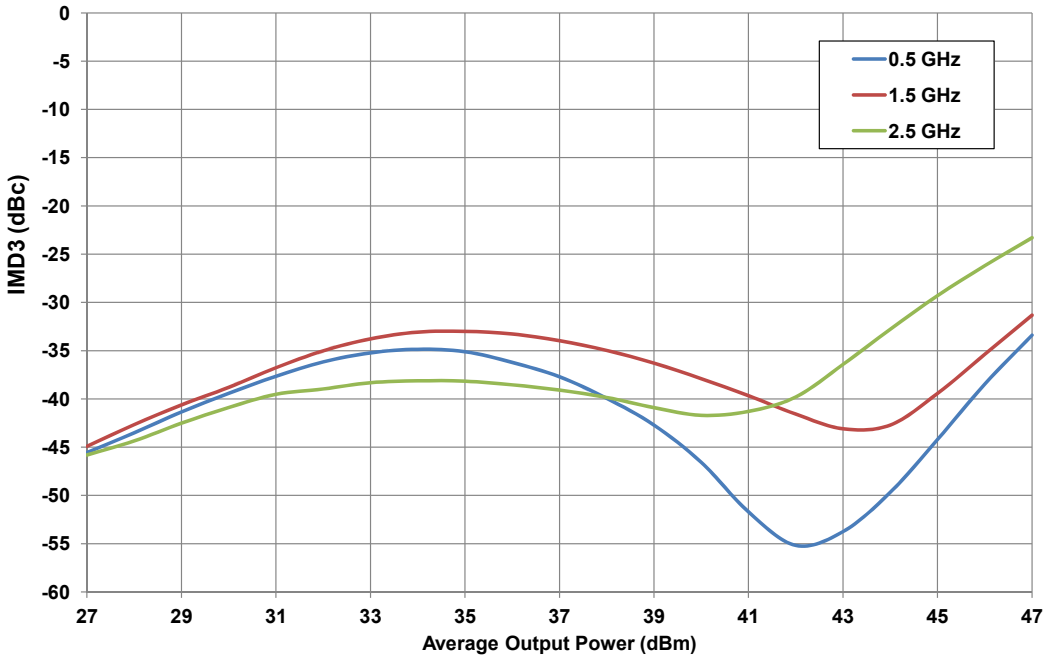
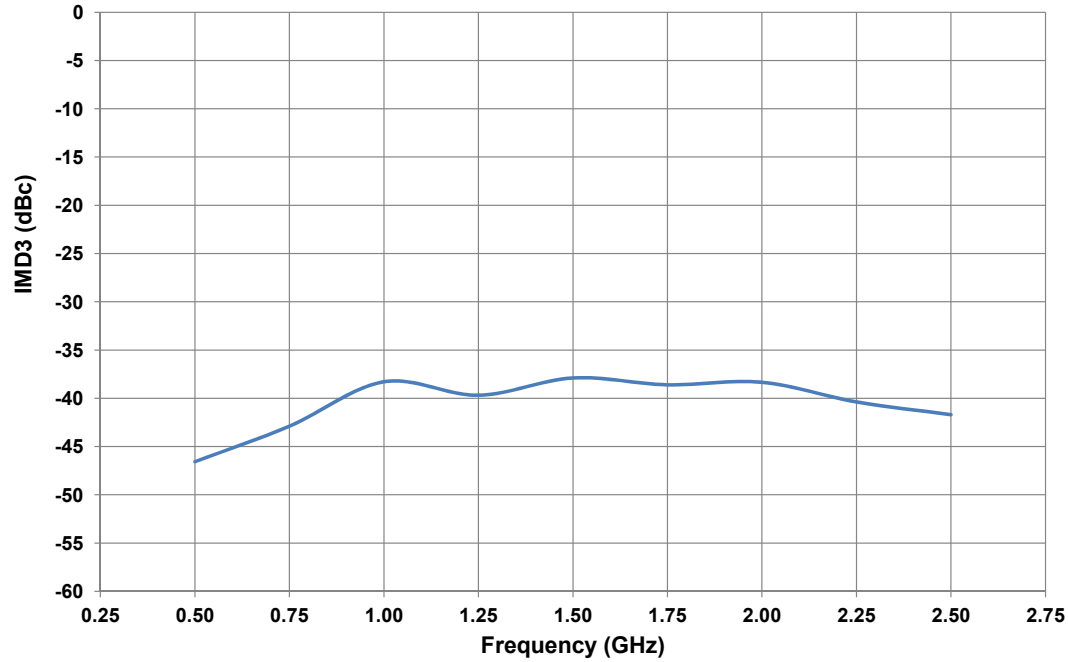


Figure 4. - Third Order Intermodulation Distortion vs Frequency measured in Broadband Amplifier Circuit CGHV40100-AMP Spacing = 1 MHz, V_{DD} = 50 V, I_{DQ} = 600 mA, Tcase = 25°C



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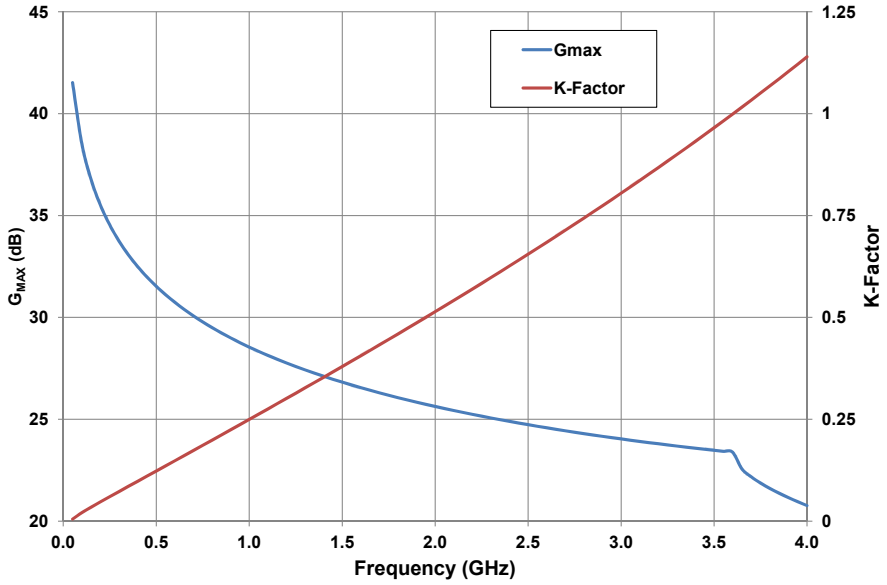
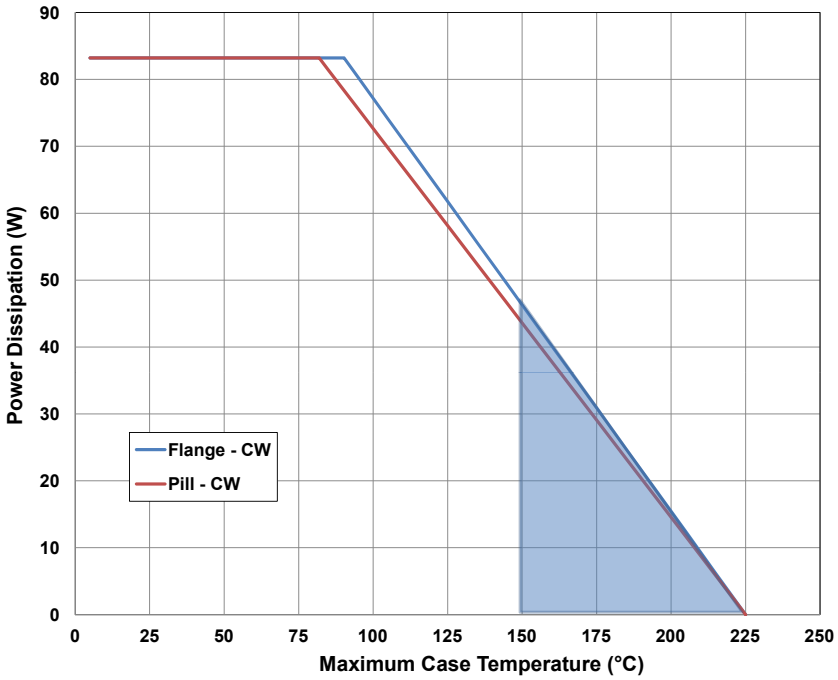
CGHV40100 Typical Performance

Figure 5. - G_{MAX} and K-Factor vs Frequency
V_{DD} = 50 V, I_{DQ} = 600 mA, Tcase = 25°C



CGHV40100 Power Dissipation De-rating Curve

Figure 6. - Transient Power Dissipation De-Rating Curve



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

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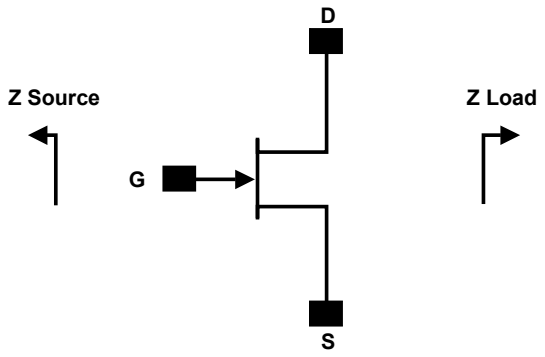
Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
500	0.43 + j5.25	8.83 + j0.85
750	0.40 + j2.62	10.78 + j2.50
1000	0.30 + j1.31	9.06 + 4.23
1250	0.30 + j0.44	7.40 + j3.85
1500	0.30 - j0.44	6.39 + j3.44
1750	0.25 - j0.87	4.41 + j3.03
2000	0.25 - j1.31	3.68 + j2.17
2250	0.25 - j2.18	3.42 + j2.17
2500	0.26 - j2.62	2.65 + j1.74

Note 1. V_{DD} = 50 V, I_{DQ} = 600 mA in the 440193 package.
Note 2. Optimized for power gain, P_{SAT} and PAE.

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	2 (125 V to 250 V)	JEDEC JESD22 C101-C

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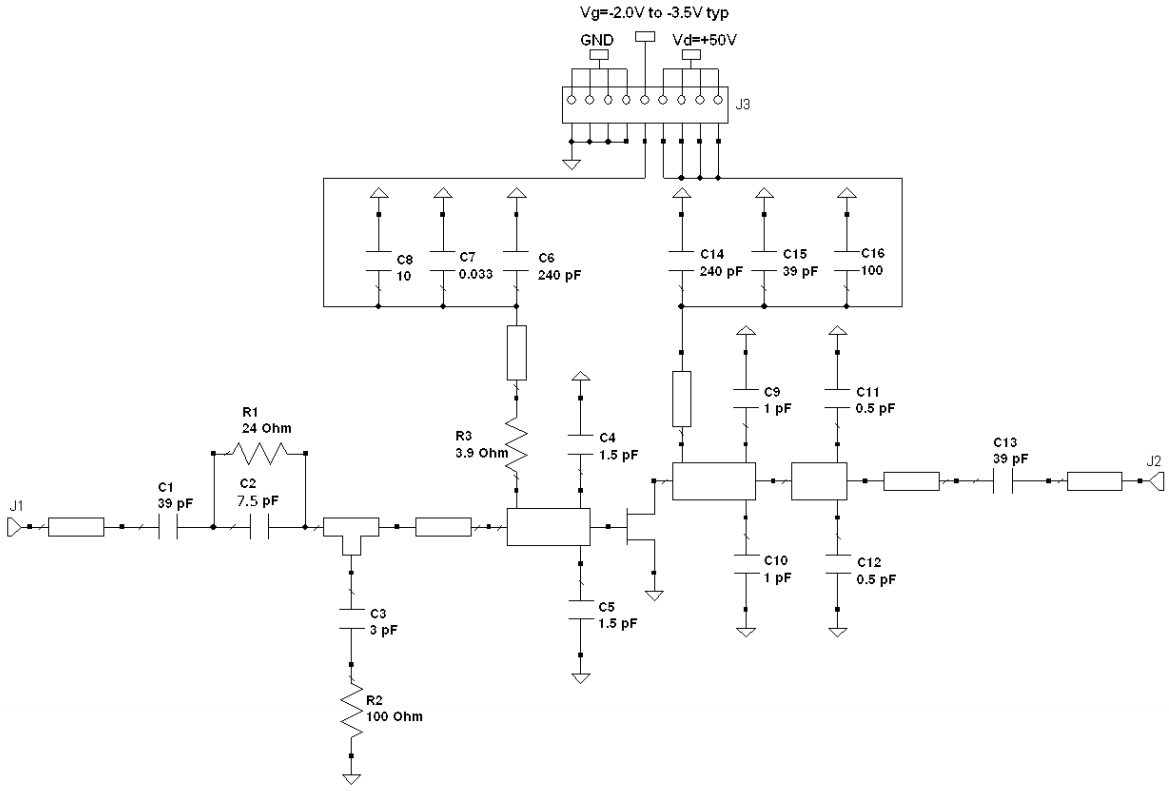
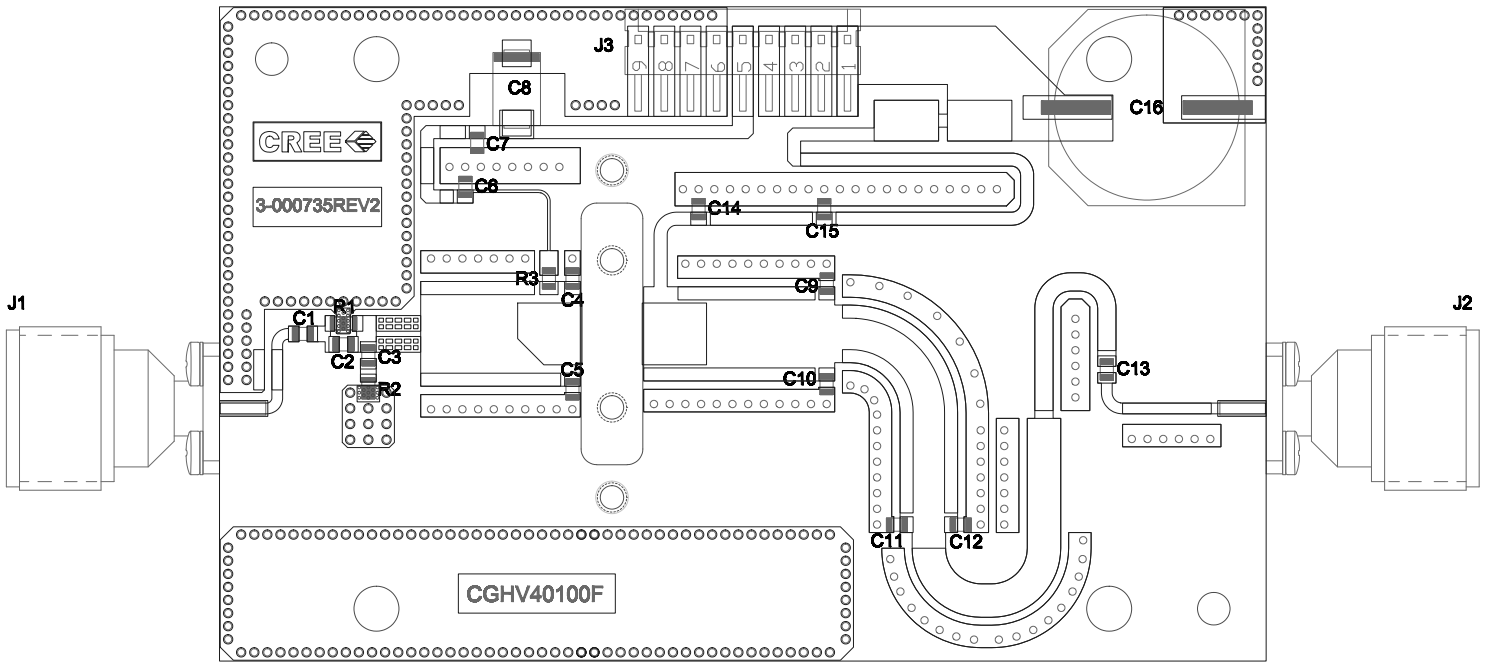
CGHV40100-AMP Application Circuit Schematic



CGHV40100-AMP Application Circuit



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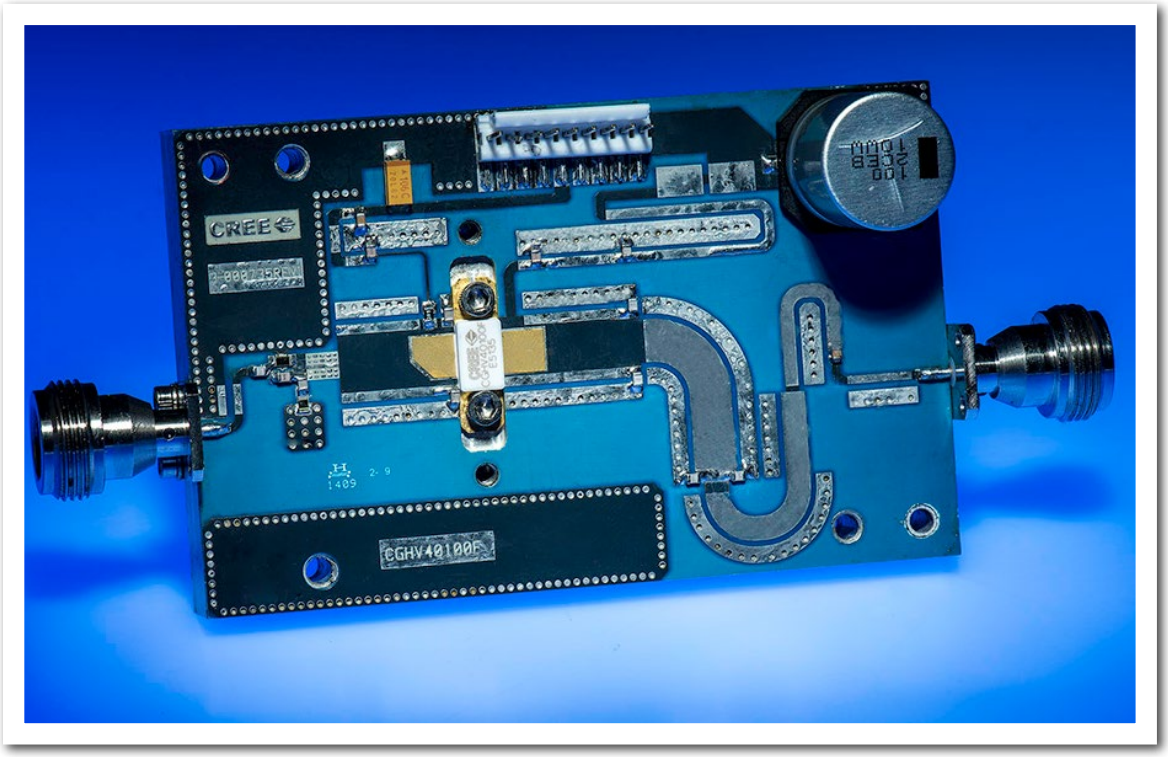
CGHV40100-AMP Application Circuit Bill of Materials

Designator	Description	Qty
C1, C13, C15	CAP, 39 pF, ± 0.1 pF, 250V, 0805, ATC600F	3
C2	CAP, 7.5 pF, ± 0.1 pF, 250 V, 0806, ATC600F	1
C3	CAP, 3 pF ± 0.1 pF, 250 V, 0805, ATC600F	1
C4, C5	CAP, 1.5 pF, ± 0.1 pF, 250 V, 0805, ATC600F	2
C7	CAP, 33000 pF, 0805 100V, X7R	1
C6, C14	CAP, 240 pF, ± 0.5 pF, 250 V, 0805, ATC600F	2
C8	CAP, 10 UF, 16V TANTALUM, 2312	1
C9, C10	CAP, 1 pF, ± 0.1 pF, 250 V, 0805, ATC600F	2
C11, C12	CAP, 0.5 pF, ± 0.1 pF, 250 V, 0805, ATC600F	2
C16	CAP, 100 UF, 20%, 160 V, ELEC	1
R1	RES, 24 OHMS, IMS ND3-1005CS24R0G	1
R2	RED, 100 OHMS, IMS ND3-0805EW1000G	1
R3	RES, 3.9 OHMS, 0805	1
J1, J2	CONN, SMA, PANEL MOUNT JACK	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
	BASEPLATE, CGH35120	1
	PCB, RO4350B, 2.5" X 4" X 0.020", CGHV40100F	1

CGHV40100-AMP Demonstration Amplifier Circuit



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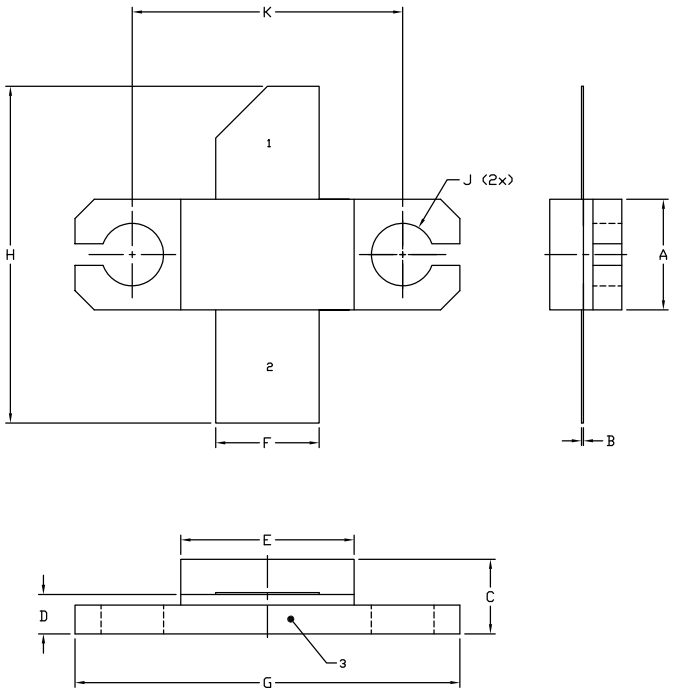
Product Dimensions CGHV40100F (Package Type — 440193)



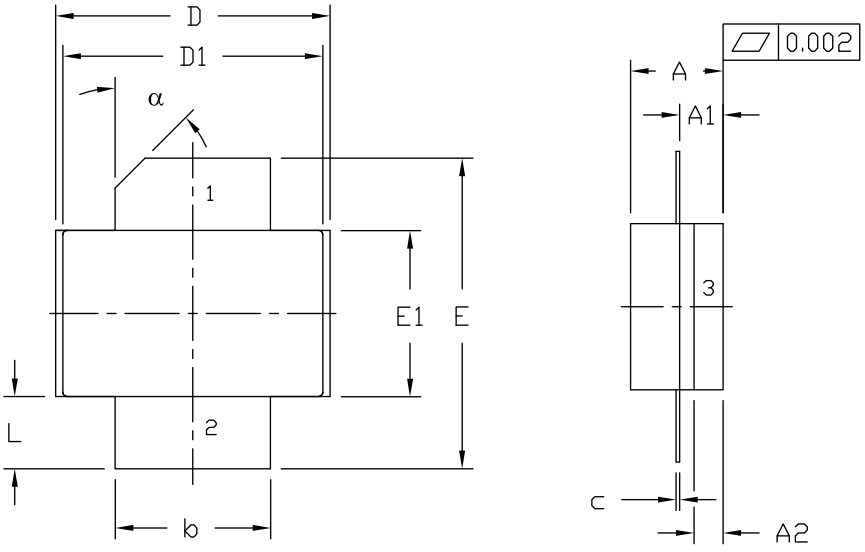
NOTES:

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

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	ø .130		3.30	
k	0.562		14.28	

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

Product Dimensions CGHV40100P (Package Type — 440206)



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M – 1994.
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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
2. DRAIN
3. SOURCE

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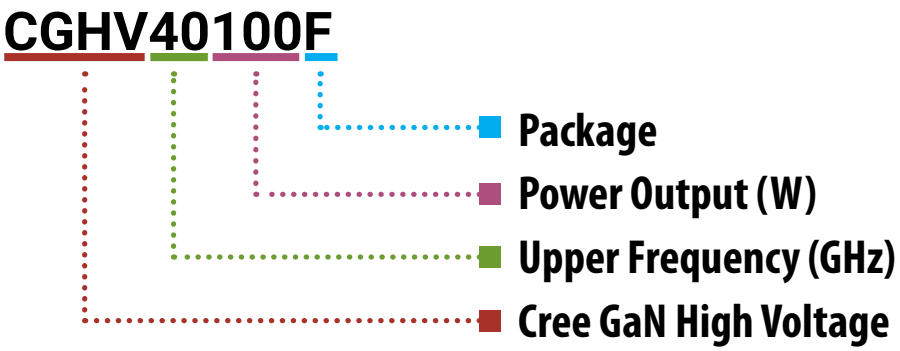
Part Number System



Parameter	Value	Units
Upper Frequency[1]	4.0	GHz
Power Output	100	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.

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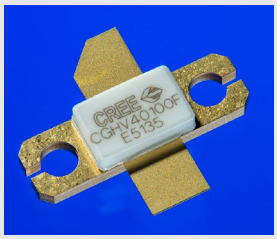
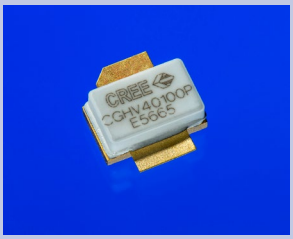
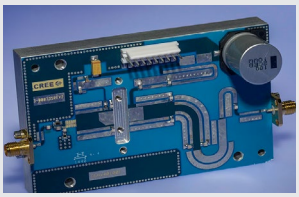
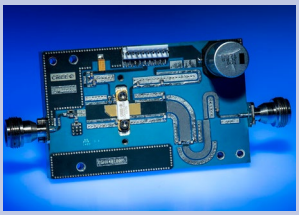
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV40100F	GaN HEMT	Each	
CGHV40100P	GaN HEMT	Each	
CGHV40100-TB	Test board without GaN HEMT	Each	
CGHV40100F-AMP	Test board with GaN HEMT (flanged) installed	Each	
CGHV40100P-AMP	Test board with GaN HEMT(pill) installed	Each	Photo TBD

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