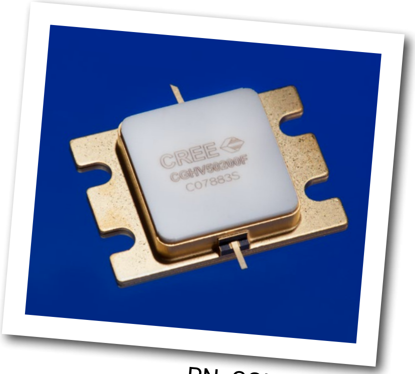
CGHV50200F

200 W, 4400 - 5000 MHz, 50-Ohm Input/Output Matched, GaN HEMT

Cree's CGHV50200F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGHV50200F ideal for troposcatter communications, 4.4 - 5.0 GHz C-Band SatCom applications and Beyond Line of Sight. The GaN HEMT is matched to 50 ohm, for ease of use. It is designed for CW, pulse, and linear mode of power amplifier operation. The transistor is supplied in a ceramic/metal flange package, type 440217.



PN: CGHV50200F
Package Type: 440217

Typical Performance Over 4.4-5.0 GHz (T_C = 25˚C) of Demonstration Amplifier

Parameter	4.4 GHz	4.6 GHz	4.8 GHz	5.0 GHz	Units
Small Signal Gain	14.9	14.9	14.9	15.1	dB
CW Output Power[1]	173	177	170	166	W
Output Power[2]	100	100	126	101	W
Power Gain[2]	11.4	11.6	11.0	11.8	dB
Power Added Efficiency[2]	49	47	48	48	%

[1]Note: Measured CW in the CGHV50200F-AMP at P_{IN} = 43 dBm
[2]Note: Measured at -30 dBc, 1.6 MHz from carrier, in the CGHV50200F-AMP under OQPSK modulation, 1.6 Msps, PN23, Alpha Filter = 0.2.

Features

- 4.4 - 5.0 GHz Operation
- 180 W Typical P_{SAT}
- 11.5 dB Typical Power Gain
- 48% Typical Power Efficiency
- 50 Ohm Internally Matched

Applications

- Troposcatter Communications
- Beyond Line of Sight – BLOS
- Satellite Communications

Large Signal Models Available for ADS and MWO

Rev 3.0 – February 2019

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}	41.6	mA	25˚C
Maximum Drain Current[1]	I_{DMAX}	17	A	25˚C
Soldering Temperature[2]	T_S	245	˚C	
Screw Torque	τ	40	in-oz	
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.81	˚C/W	CW, 85˚C, P_{DISS} = 166.4 W
Case Operating Temperature[3]	T_C	-40, +125	˚C	

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] See also, Power Dissipation Derating Curve on page 12

Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1] (T_C = 25˚C)						
Gate Threshold Voltage	$V_{GS(th)}$	-3.4	-3.0	-2.6	V_{DC}	V_{DS} = 10 V, I_D = 41.6 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	V_{DC}	V_{DS} = 40 V, I_D = 1.0 A
Saturated Drain Current[2]	I_{DS}	33.28	37.4	–	A	V_{DS} = 6 V, V_{GS} = 2 V
Drain-Source Breakdown Voltage	V_{BR}	150	–	–	V_{DC}	V_{GS} = -8 V, I_D = 41.6 mA
RF Characteristics[3] (T_C = 25˚C, F_0 = 4.4 - 5.0 GHz unless otherwise noted)						
Small Signal Gain	G_{SS1}	14	15.4	–	dB	V_{DD} = 40 V, I_D = 1.0 A, P_{IN} = 10 dBm, Freq = 4.4 GHz
Small Signal Gain	G_{SS2}	14	15.3	–	dB	V_{DD} = 40 V, I_D = 1.0 A, P_{IN} = 10 dBm, Freq = 4.8 GHz
Small Signal Gain	G_{SS3}	14.25	15.2	–	dB	V_{DD} = 40 V, I_D = 1.0 A, P_{IN} = 10 dBm, Freq = 5.0 GHz
Power Gain[4]	G_{P1}	10.5	12.1	–	dB	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 4.4 GHz
Power Gain[4]	G_{P2}	10.5	12.4	–	dB	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 4.8 GHz
Power Gain[4]	G_{P3}	10.5	12.2	–	dB	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 5.0 GHz
Power Added Efficiency[4]	PAE_1	30	42	–	%	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 4.4 GHz
Power Added Efficiency[4]	PAE_2	30	37	–	%	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 4.8 GHz
Power Added Efficiency[4]	PAE_3	30	40	–	%	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 5.0 GHz
OQPSK Linearity[4]	$ACLR_1$	–	-29	-25	dBc	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 4.4 GHz
OQPSK Linearity[4]	$ACLR_2$	–	-34	-28	dBc	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 4.8 GHz
OQPSK Linearity[4]	$ACLR_3$	–	-34	-26	dBc	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 5.0 GHz
Output Mismatch Stress	VSWR	–	–	3 : 1	Ψ	No damage at all phase angles, V_{DD} = 40 V, I_D = 1.0 A, CW P_{OUT} = 180 W

Notes:
[1] Measured on wafer prior to packaging.
[2] Scaled from PCM data.
[3] Measured in CGHV50200F-AMP
[4] Measured under 1.6 Msps OQPSK Modulation, PN23, Alpha Filter = 0.2

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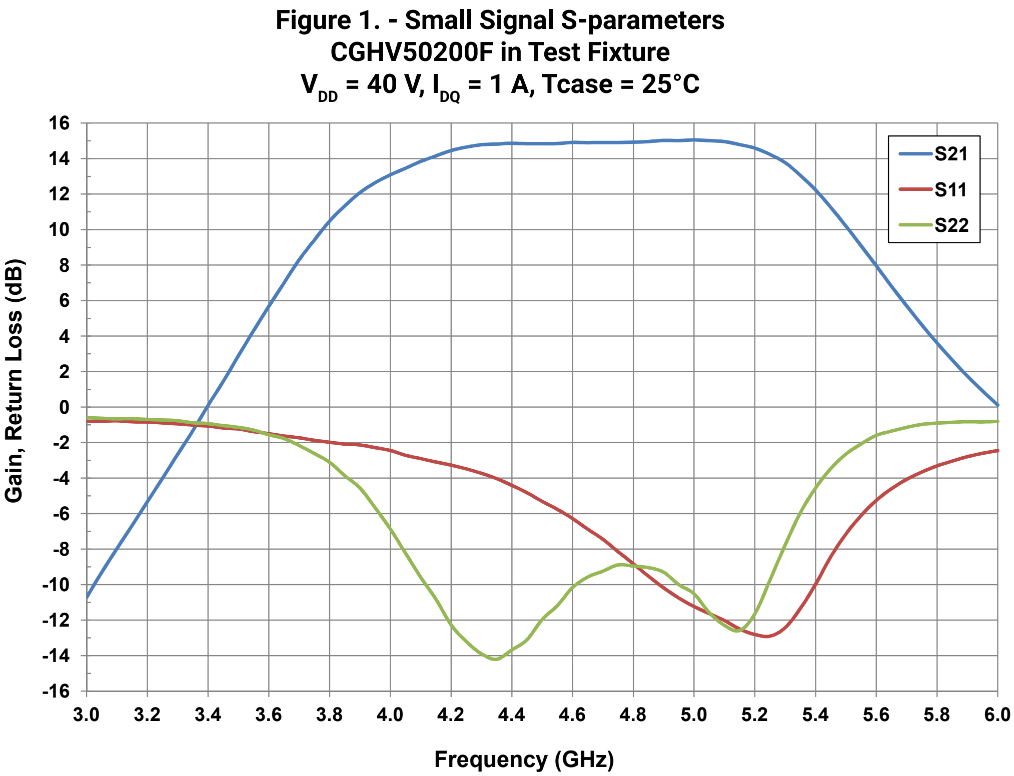
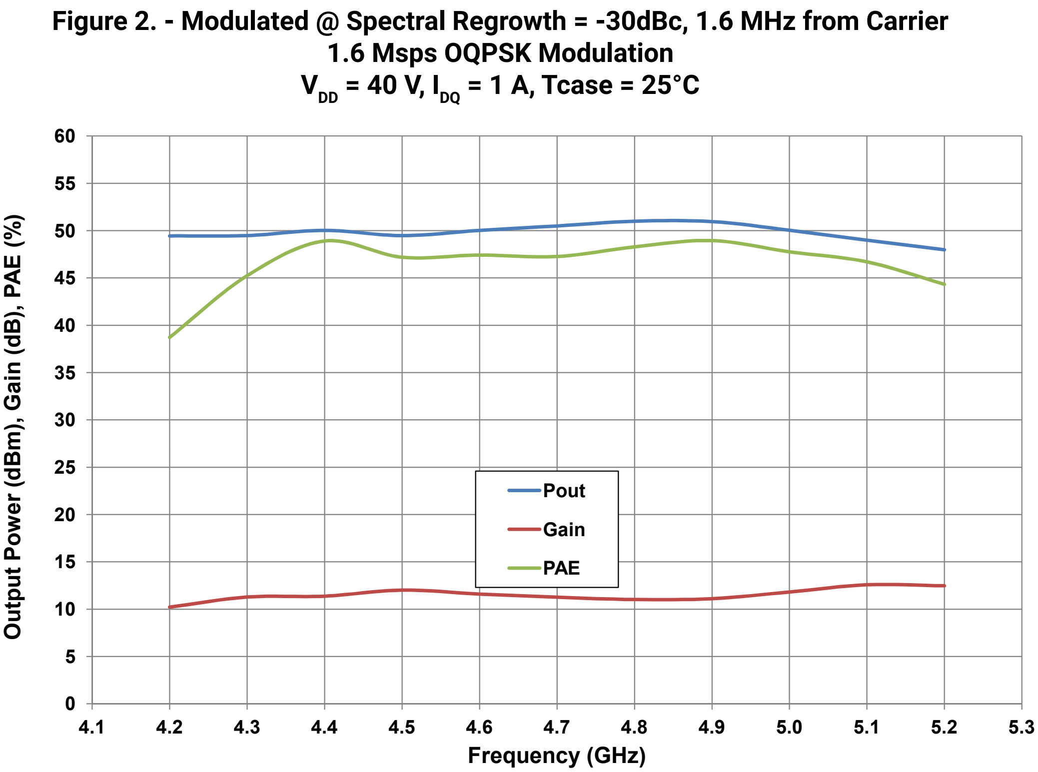
Typical Performance





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Typical Performance

Figure 3. - Spectral Mask @ Average Output Power = 48dBm
1.6 Msps OQPSK Modulation
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C

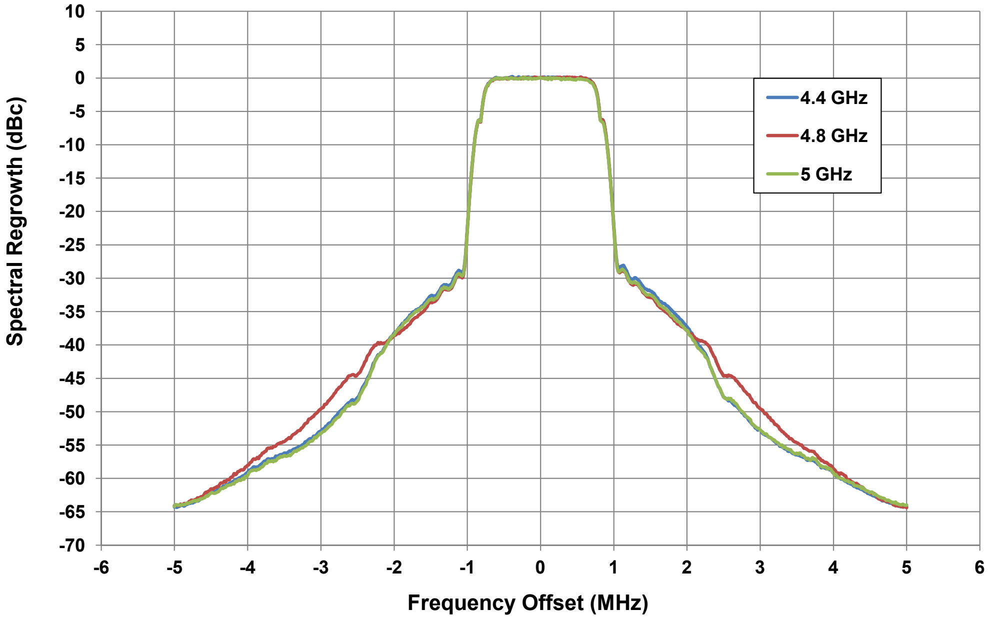
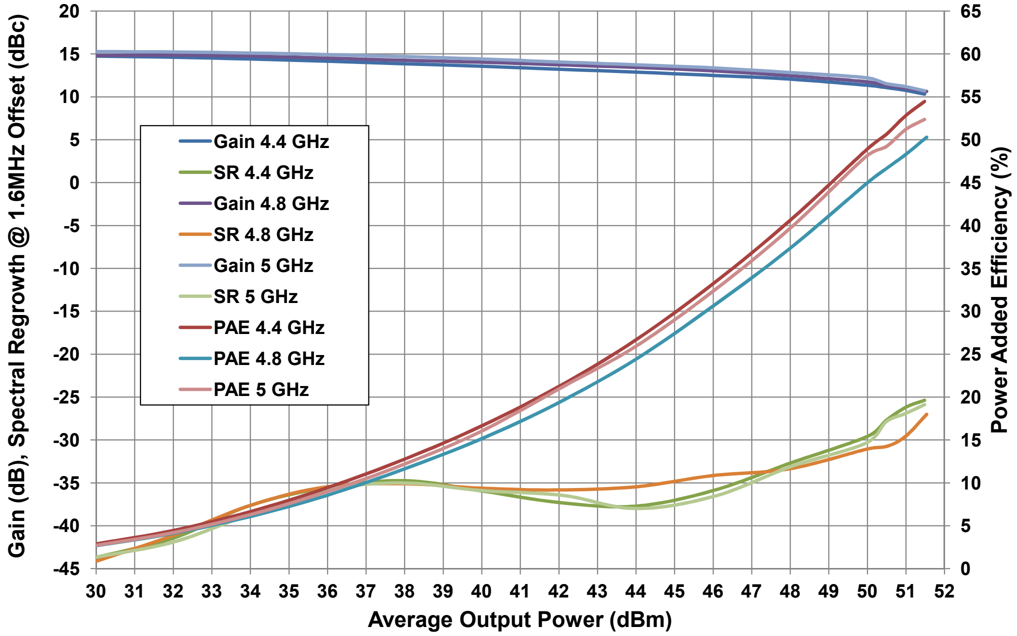


Figure 4. - Modulated Power Sweep
1.6 Msps OQPSK Modulation
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C



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Typical Performance

Figure 5. - Modulated Power Sweep
1.6 Msps OQPSK Modulation
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C

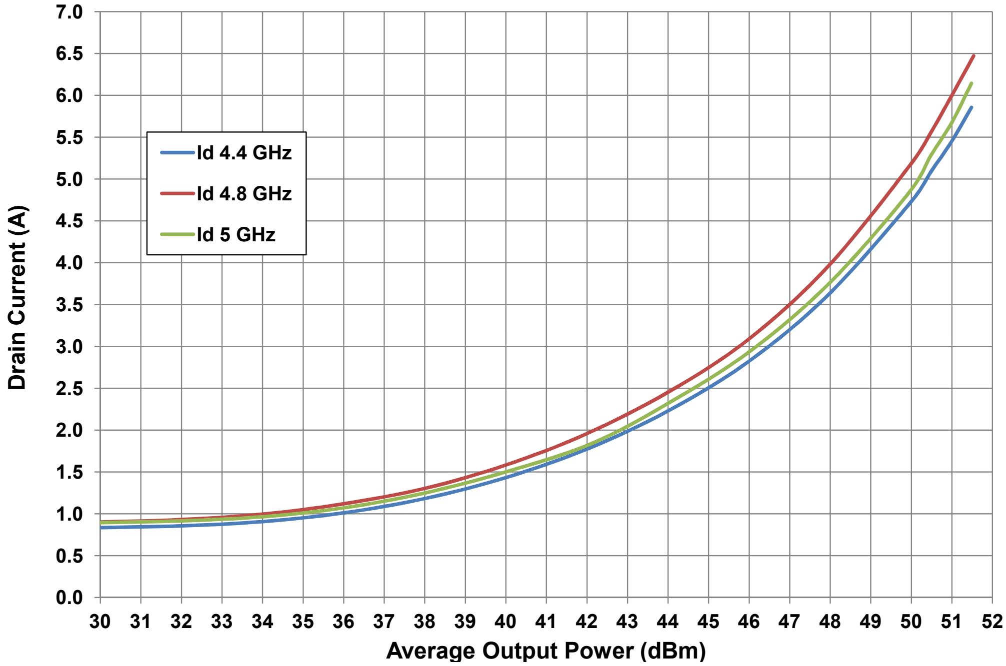
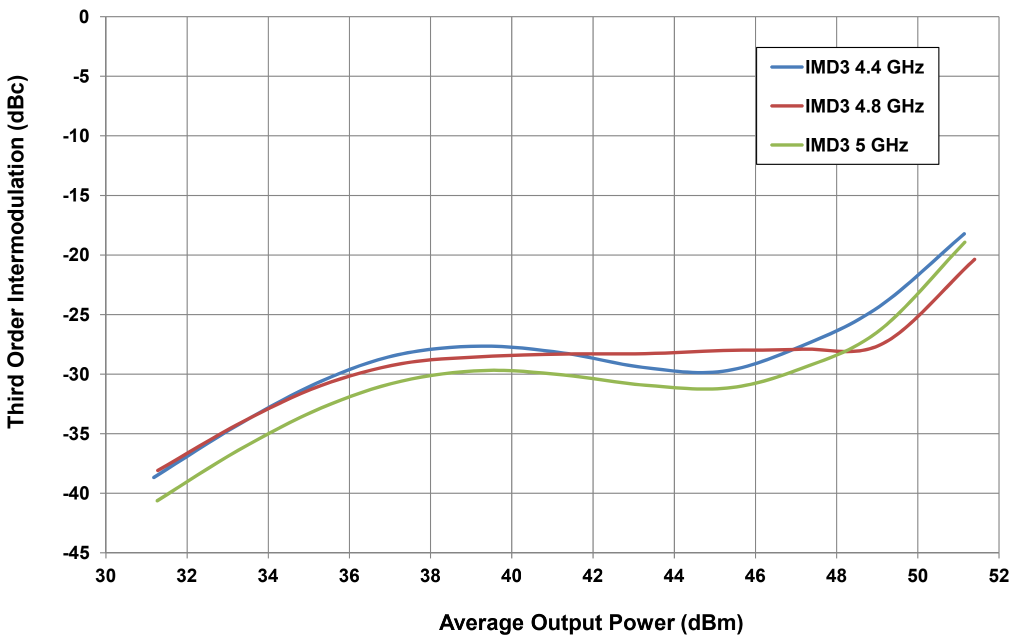


Figure 6. - Two Tone Power Sweep
IMD3 @ 1 MHz Carrier Spacing
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C



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Typical Performance

Figure 7. - Two Tone Power Sweep
IMD @ 1 MHz Carrier Spacing, 4.4 GHz
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C

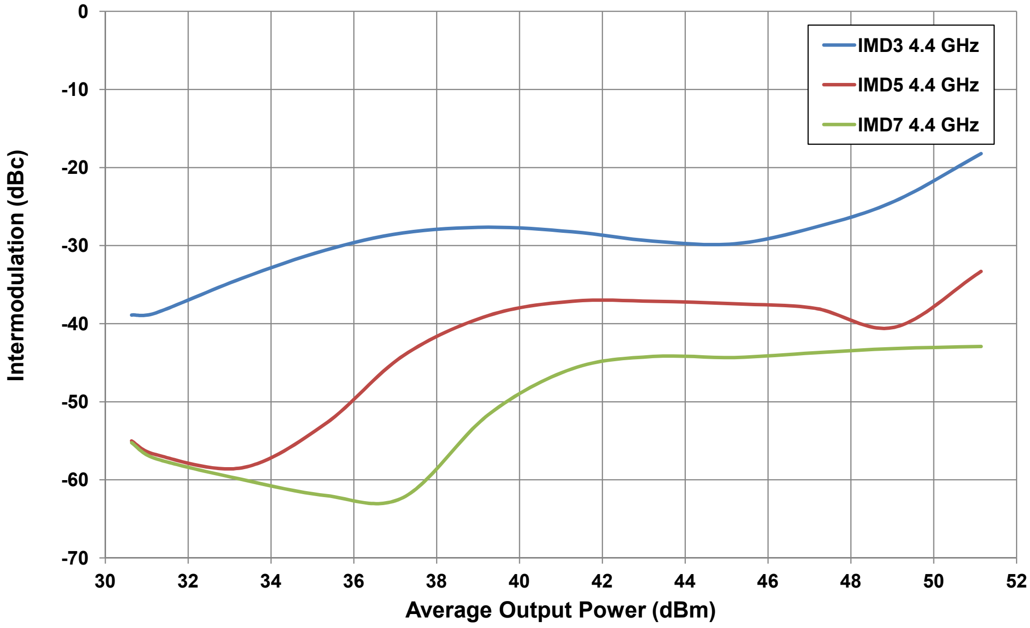
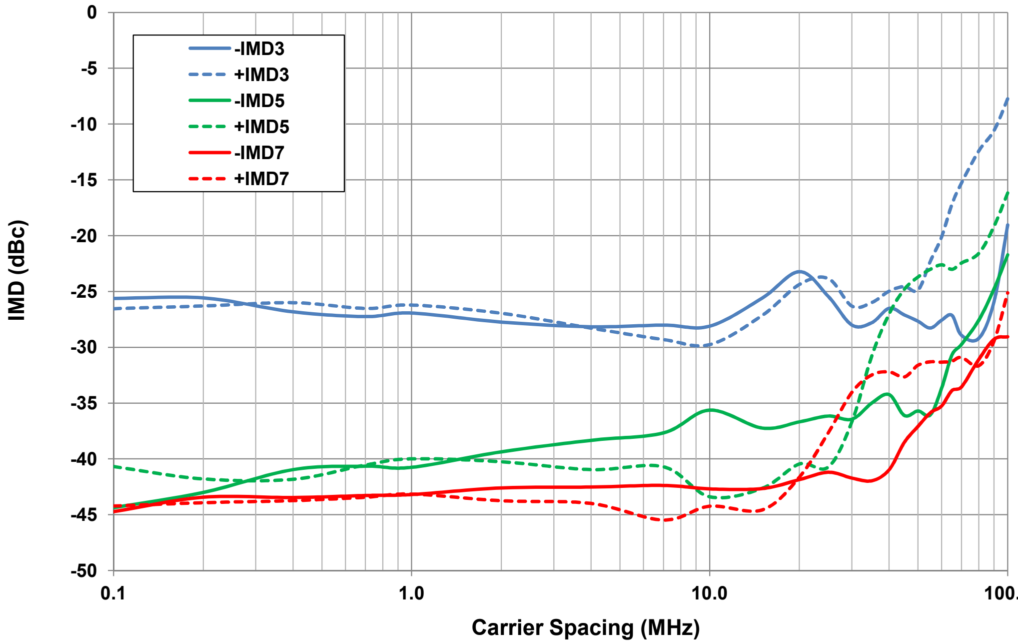


Figure 8. - Two Tone Carrier Spacing Sweep
@ 48 dBm Average Ouput Power, 4.4 GHz
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C



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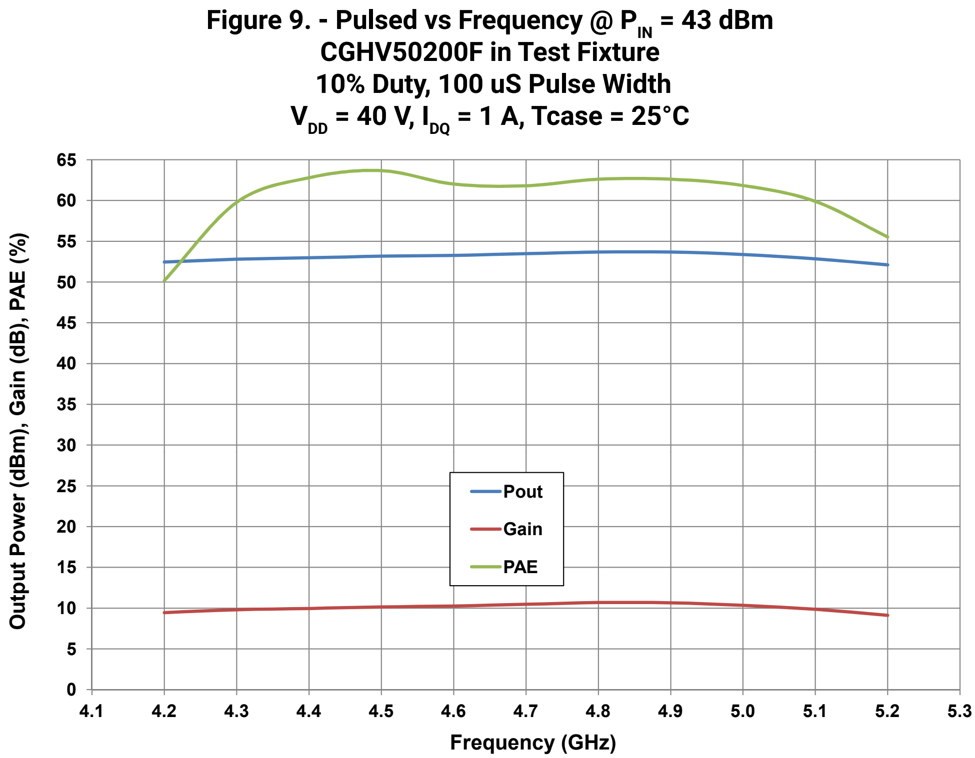

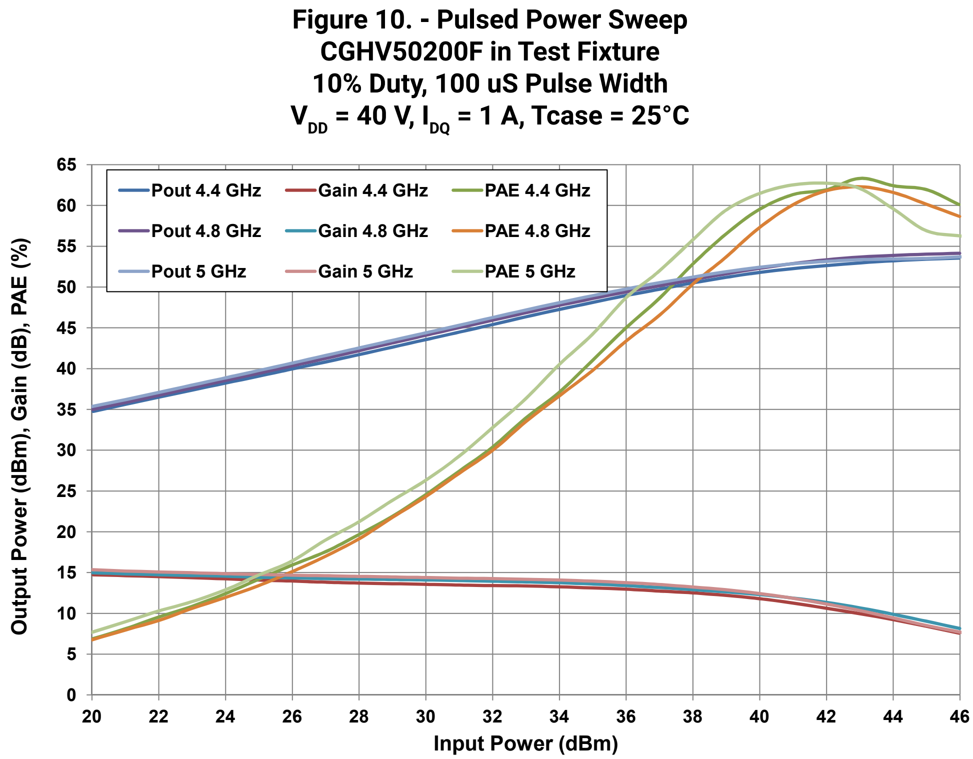

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Typical Performance

Figure 11. - AM-AM
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C

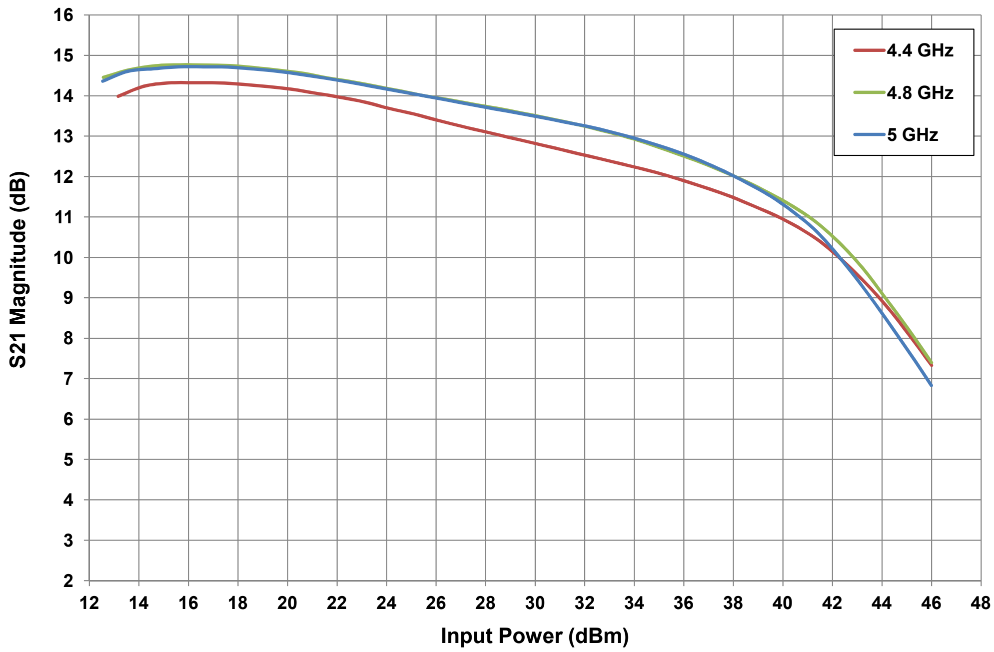
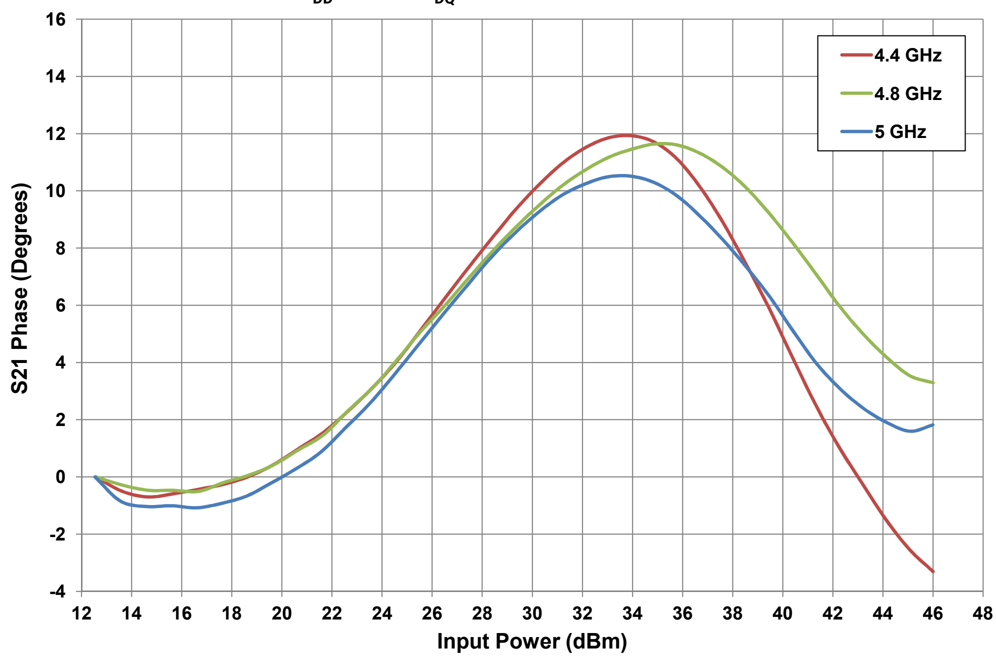


Figure 12. - AM-PM
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C



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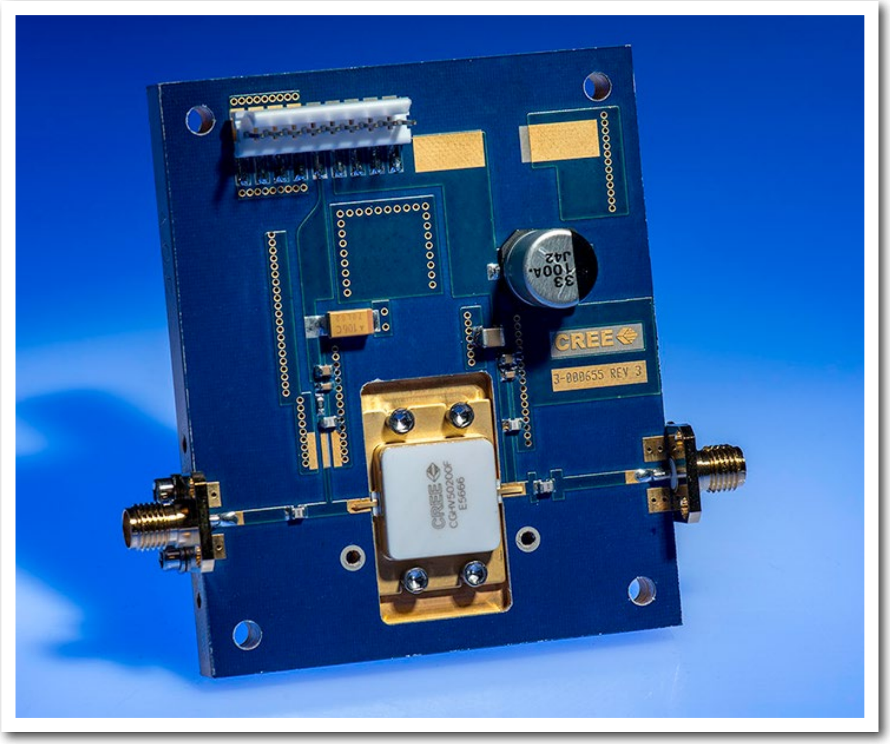
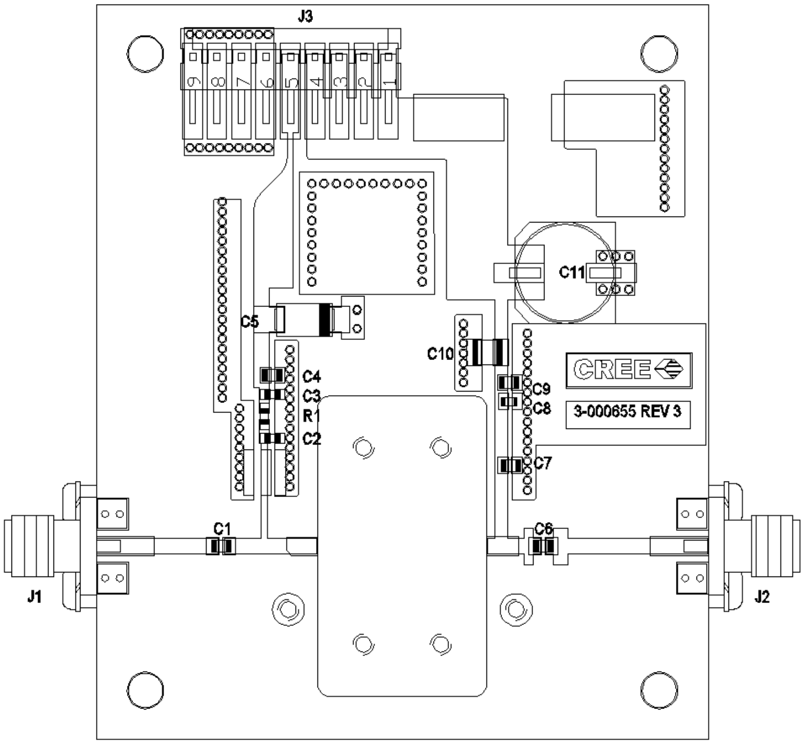
CGHV50200F-AMP Demonstration Amplifier Circuit



CGHV50200F-AMP Demonstration Amplifier Circuit Outline



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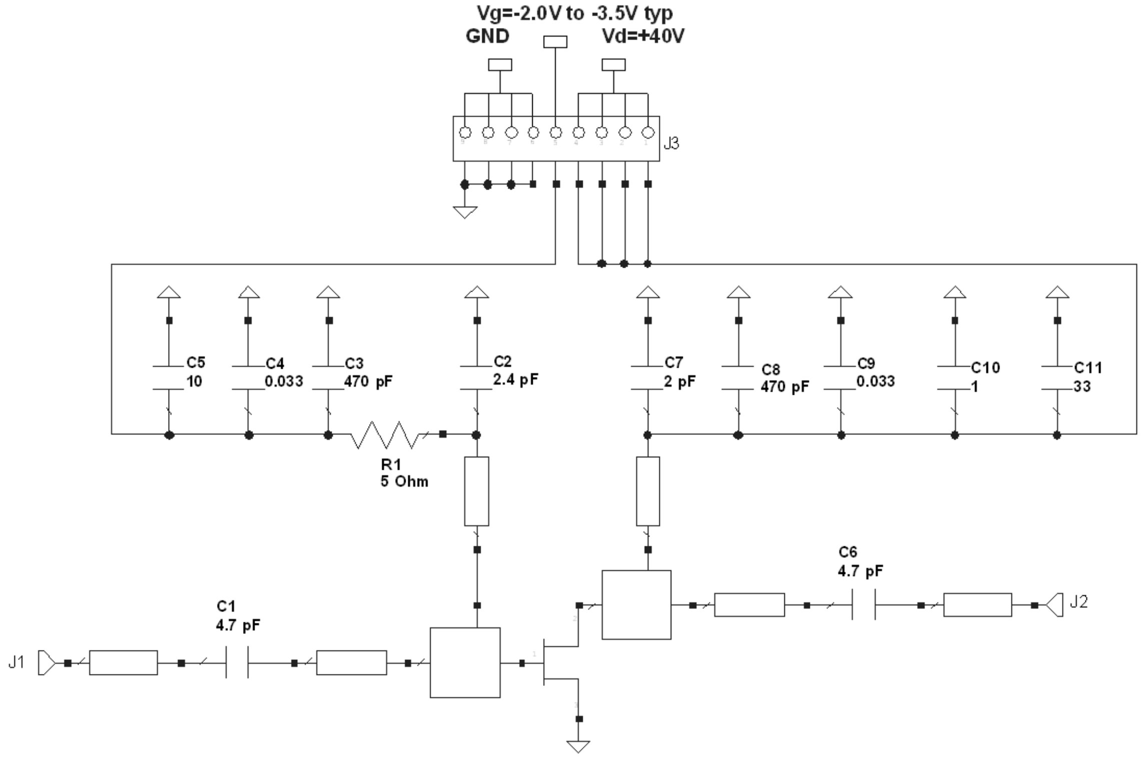
CGHV50200F-AMP Demonstration Amplifier Circuit Schematic



CGHV50200F-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 5.1,OHM, +/- 1%, 1/16W,0603	1
C1,C6	CAP, 4.7PF, +/-1%,250V, 0805,	2
C2	CAP, 2.4pF, +/- 0.25 pF,250V, 0603	1
C3,C8	CAP, 470PF, 5%, 100V, 0603, X	2
C4,C9	CAP,33000PF, 0805,100V, X7R	2
C5	CAP 10UF 16V TANTALUM	1
C7	CAP, 2.0PF, +/-1%,250V, 0805,	1
C10	CAP, 1.0UF, 100V, 10%, X7R, 1210	1
C11	CAP, 33 UF, 20%, G CASE	1
J1,J2	CONN, SMA, PANEL MOUNT JACK	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
-	PCB, RF35, 2.5 X 3.0 X 0.250	1
-	2-56 SOC HD SCREW 1/4 SS	4
-	#2 SPLIT LOCKWASHER SS	4
Q1	CGHV50200F	1

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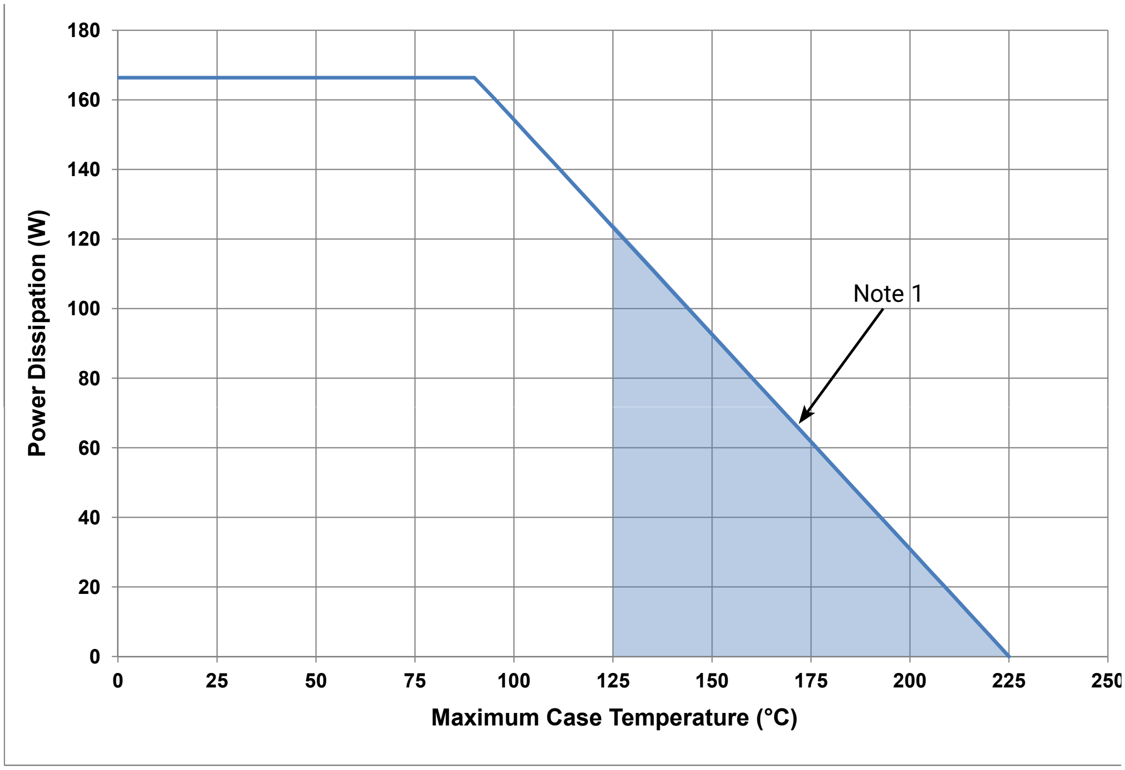
CGHV50200F Power Dissipation De-rating Curve



Note 1 : Shaded area exceeds Maximum Case Operating 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	2 (125 V to 250 V)	JEDEC JESD22 C101-C

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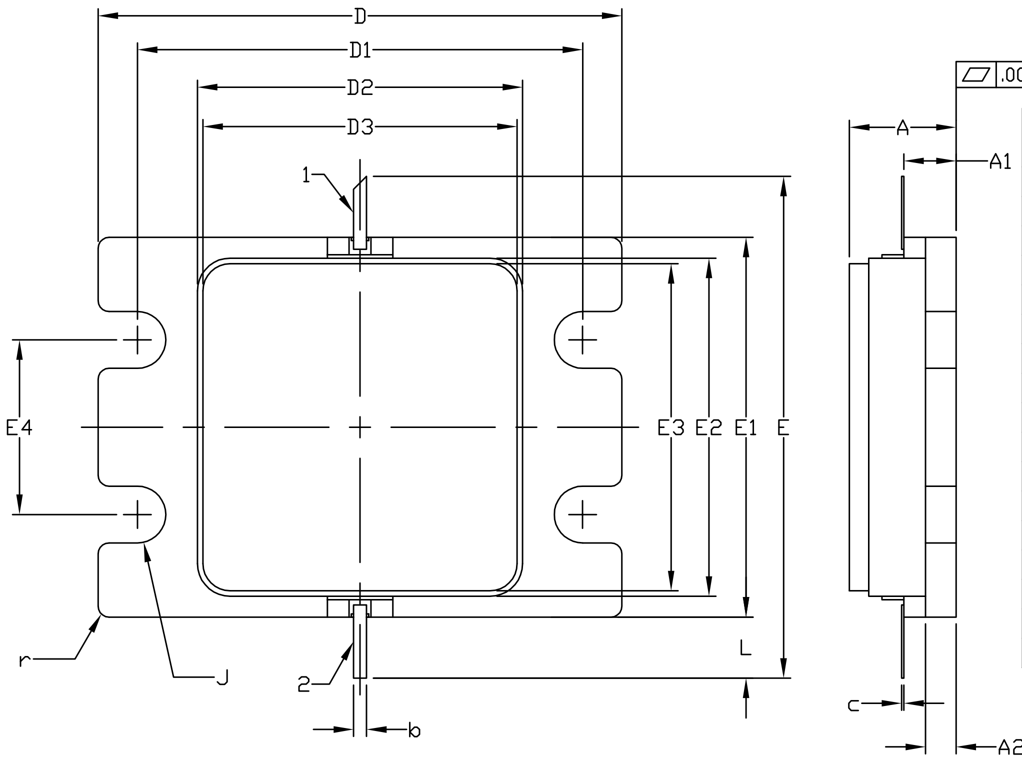
Product Dimensions CGHV50200F (Package Type — 440217)

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. INTERPRET DRAWING IN ACCORDANCE WITH ANSI Y14.5M-2009
2. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF .020 BEYOND EDGE OF LID
3. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF .008 IN ANY DIRECTION
4. ALL PLATED SURFACES ARE GOLD OVER NICKEL



1. GATE
2. DRAIN

DIM	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.188	0.198	4.78	5.03	
A1	0.088	0.100	2.24	2.54	2x
A2	0.049	0.061	1.24	1.55	
b	0.022	0.026	0.56	0.66	2x
c	0.002	0.006	0.05	0.15	
D	0.935	0.955	23.75	24.26	
D1	0.797	0.809	20.24	20.55	2x
D2	0.581	0.593	14.76	15.06	
D3	0.563	0.571	14.30	14.50	
E	0.906		23.01		REF
E1	0.679	0.691	17.25	17.55	
E2	0.604	0.616	15.34	15.65	
E3	0.586	0.594	14.88	15.09	
E4	0.309	0.321	7.85	8.15	2x
J	ø0.097	ø0.107	ø2.46	ø2.72	4x
L	0.090	0.130	2.29	3.30	2x
r	0.02 TYP		0.51 TYP		12x

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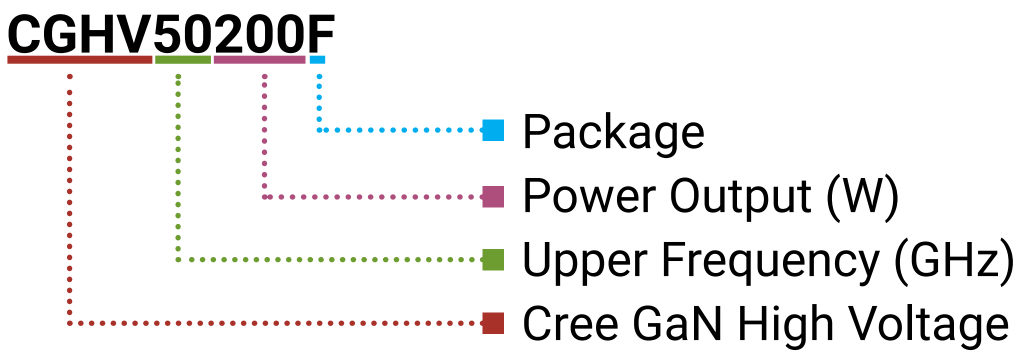
Part Number System



Parameter	Value	Units
Upper Frequency[1]	5.0	GHz
Power Output	200	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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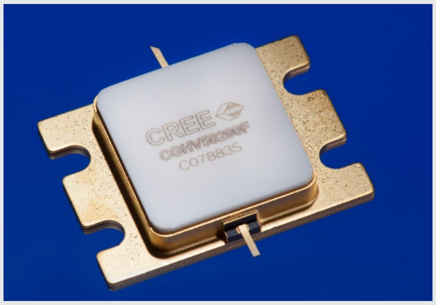
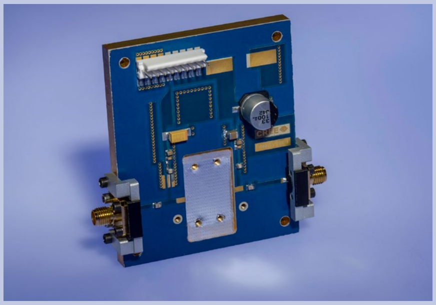
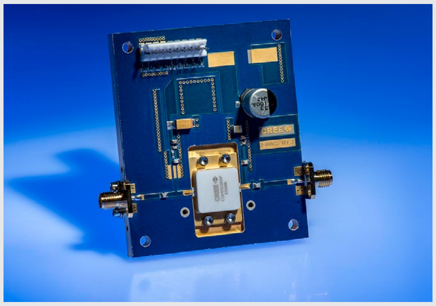
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV50200F	GaN HEMT	Each	
CGHV50200F-TB	Test board without GaN HEMT	Each	
CGHV50200F-AMP	Test board with GaN HEMT installed	Each	

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