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 transistor is supplied in a ceramic/metal flange package, type 440215.

PN: CGHV50200F
Package Type: 440215

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]	198	213	233	218	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-TB at P_{IN} = 43 dBm
[2]Note: Measured at -30 dBc, 1.6 MHz from carrier, in the CGHV50200F-TB 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

Rev 0 – September 2014

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, +150	˚C	30 seconds

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} = 50 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}	–	15.4	–	dB	V_{DD} = 40 V, I_D = 1.0 A, P_{IN} = 10 dBm
Small Signal Gain	G_{SS2}	–	15.3	–	dB	V_{DD} = 40 V, I_D = 1.0 A, P_{IN} = 10 dBm
Small Signal Gain	G_{SS3}	–	15.2	–	dB	V_{DD} = 40 V, I_D = 1.0 A, P_{IN} = 10 dBm
Power Gain[4]	G_{P1}	–	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}	–	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}	–	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	–	45	–	%	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 4.4 GHz
Power Added Efficiency[4]	PAE_2	–	36	–	%	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 4.8 GHz
Power Added Efficiency[4]	PAE_3	–	35	–	%	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 5.0 GHz
OQPSK Linearity[4]	$ACLR_1$	–	-29	–	dBc	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 4.4 GHz
OQPSK Linearity[4]	$ACLR_2$	–	-34	–	dBc	V_{DD} = 40 V, I_D = 1.0 A, P_{OUT} = 48 dBm, Freq = 4.8 GHz
OQPSK Linearity[4]	$ACLR_3$	–	-34	–	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-TB.
[4] Measured under 1.6 Msps OQPSK Modulation, PN23, Alpha Filter = 0.2

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Typical Performance

Figure 1. - Small Signal S-parameters
CGHV50200F in Test Fixture
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C

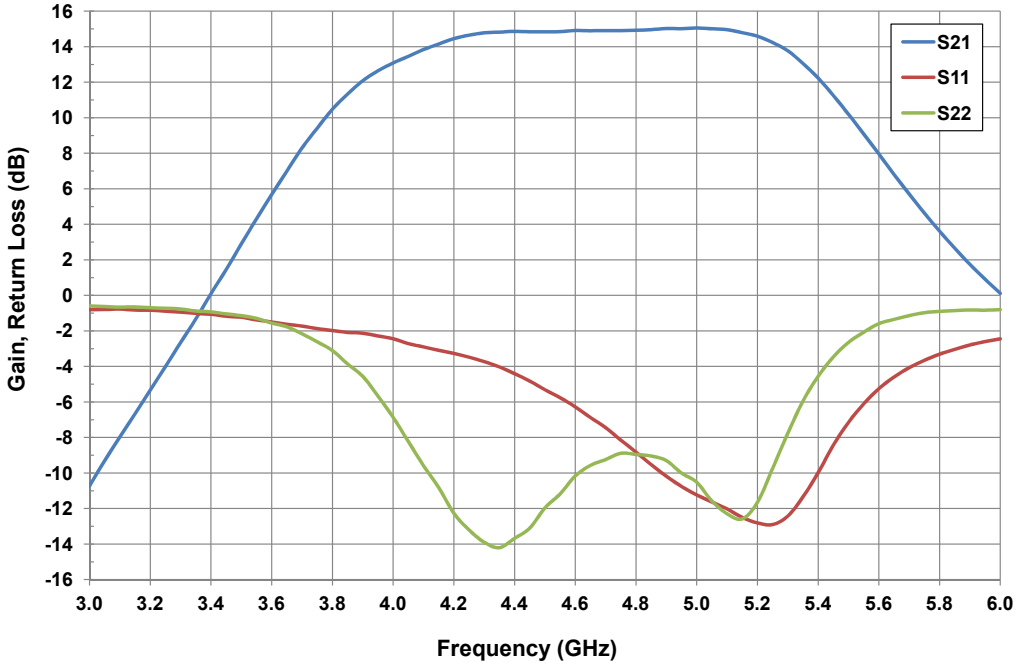

Figure 2. - Modulated @ Spectral Regrowth = -30dBc, 1.6 MHz from Carrier
1.6 Msps OQPSK Modulation
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C

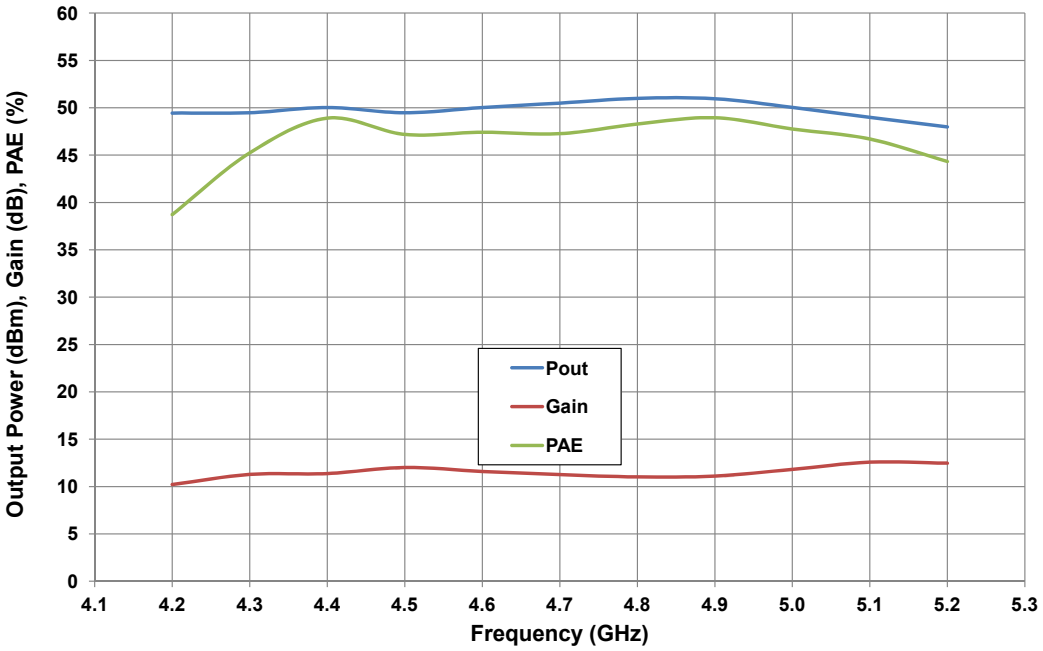

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Figure 3. - Spectral Mask @ Average Output Power = 48dBm
1.6 Msps OQPSK Modulation
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C

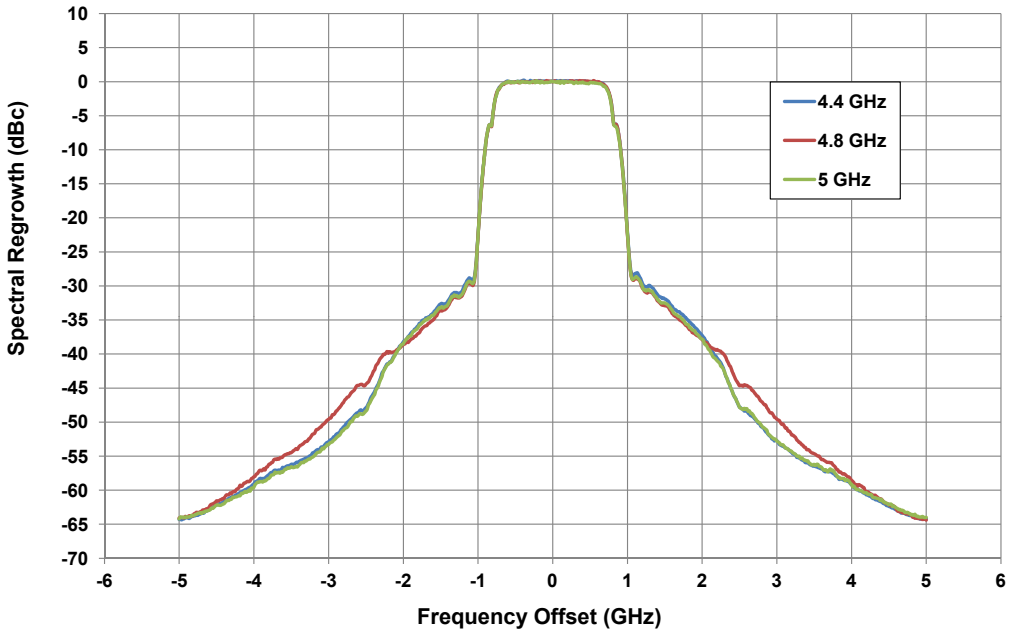
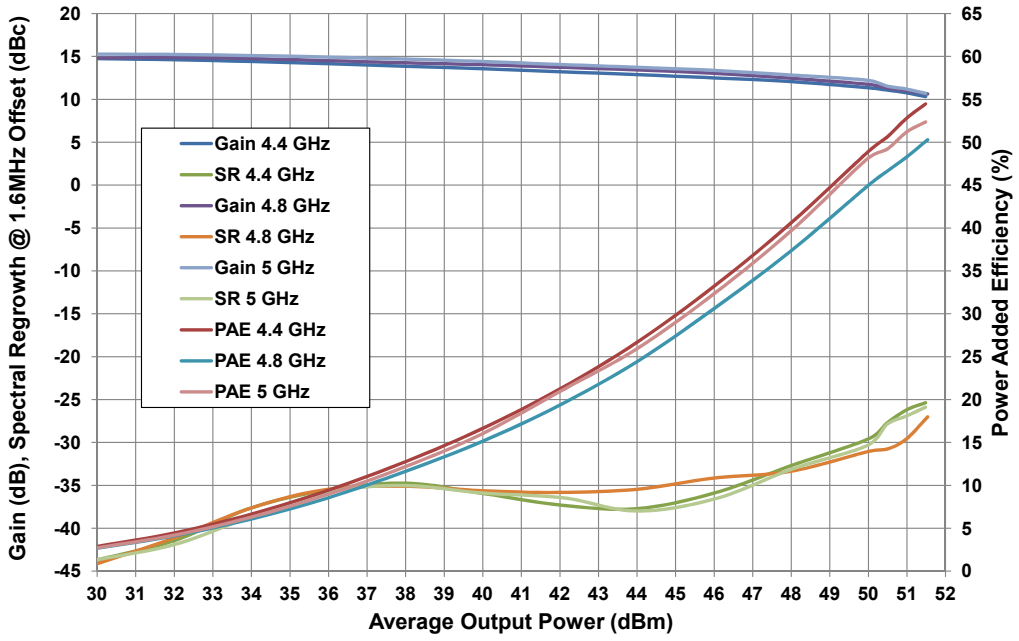


Figure 4. - Modulated Power Sweep
1.6 Msps OQPSK Modulation
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C



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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

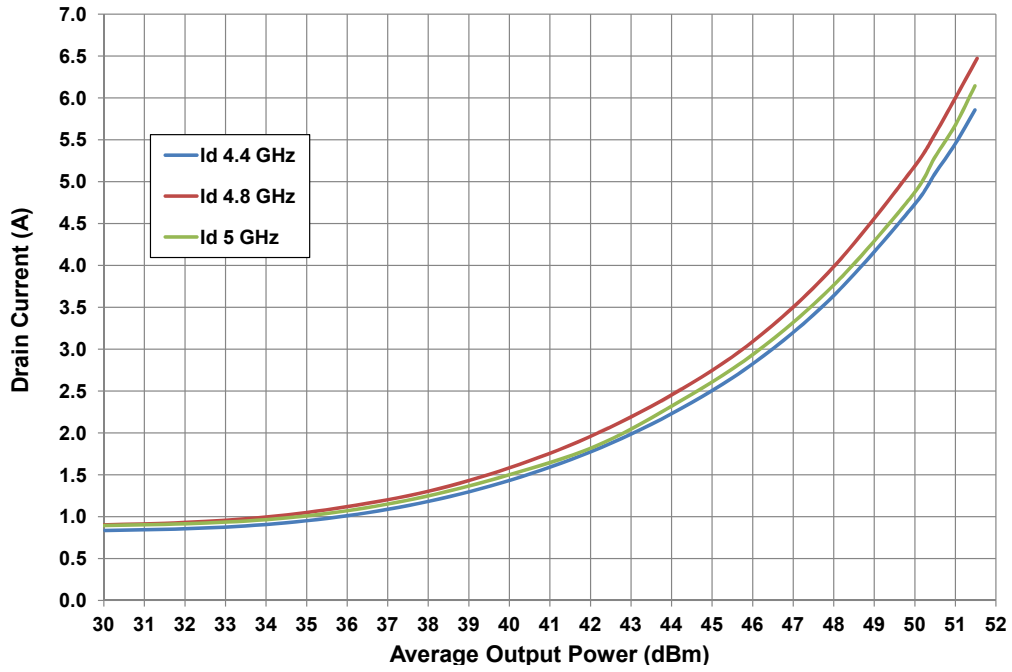
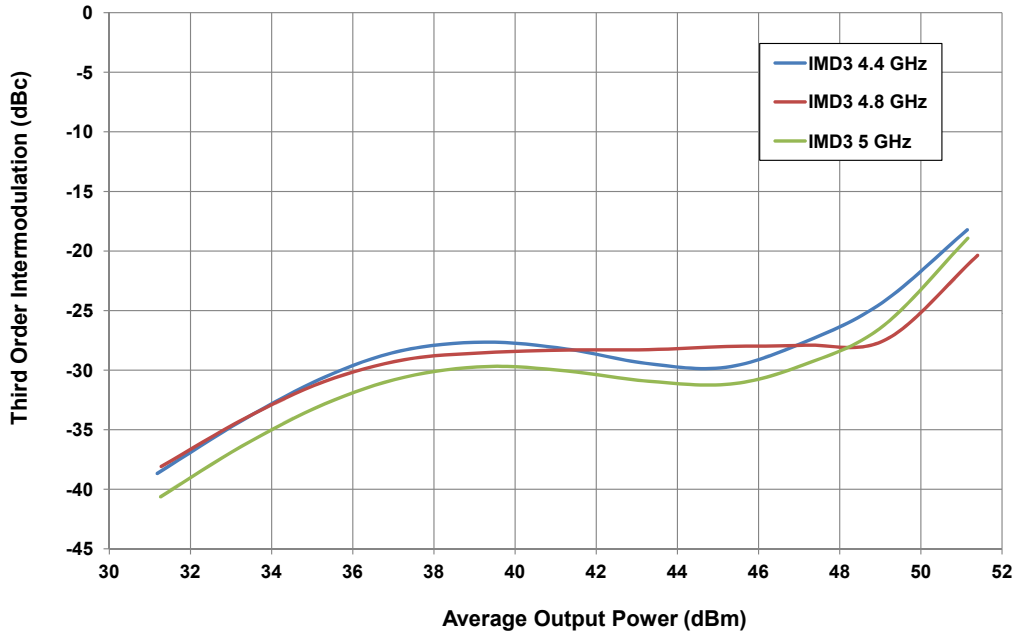


Figure 6. - Two Tone Power Sweep
IMD3 @ 1 MHz Carrier Spacing
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C



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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

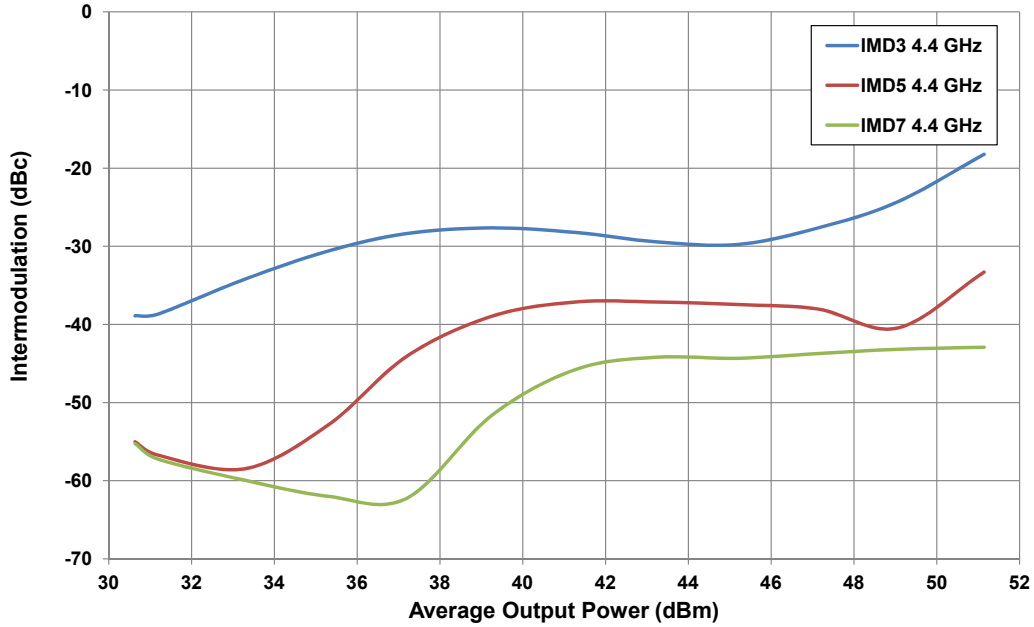
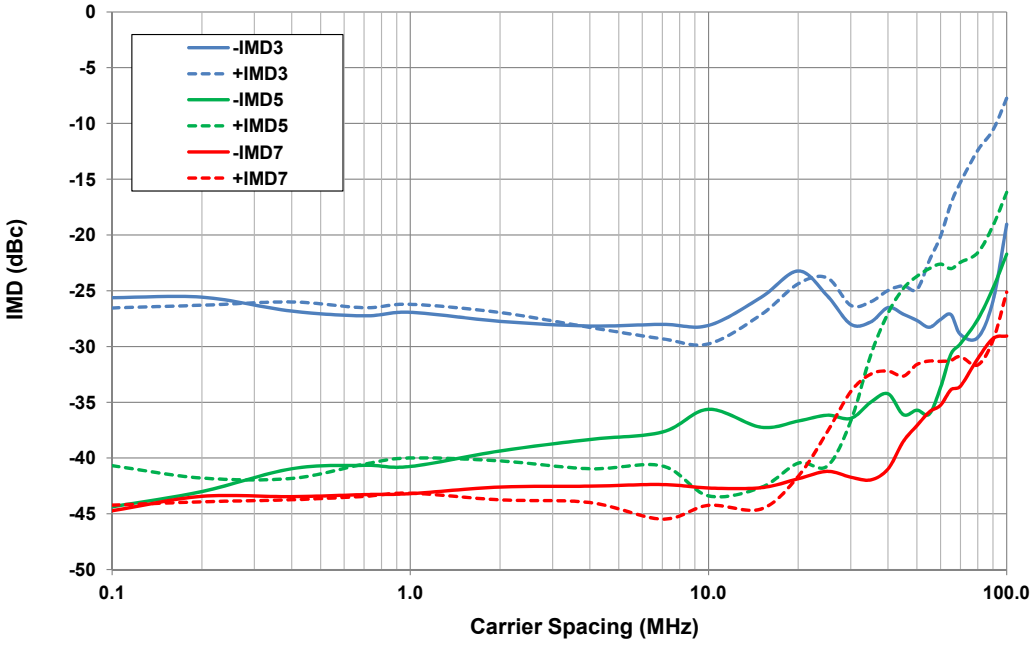


Figure 8. - Two Tone Carrier Spacing Sweep
@ 48 dBm Average Ouput Power, 4.4 GHz
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C



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Typical Performance

Figure 9. - CW vs Frequency @ P_{IN} = 43 dBm
CGHV50200F in Test Fixture
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C

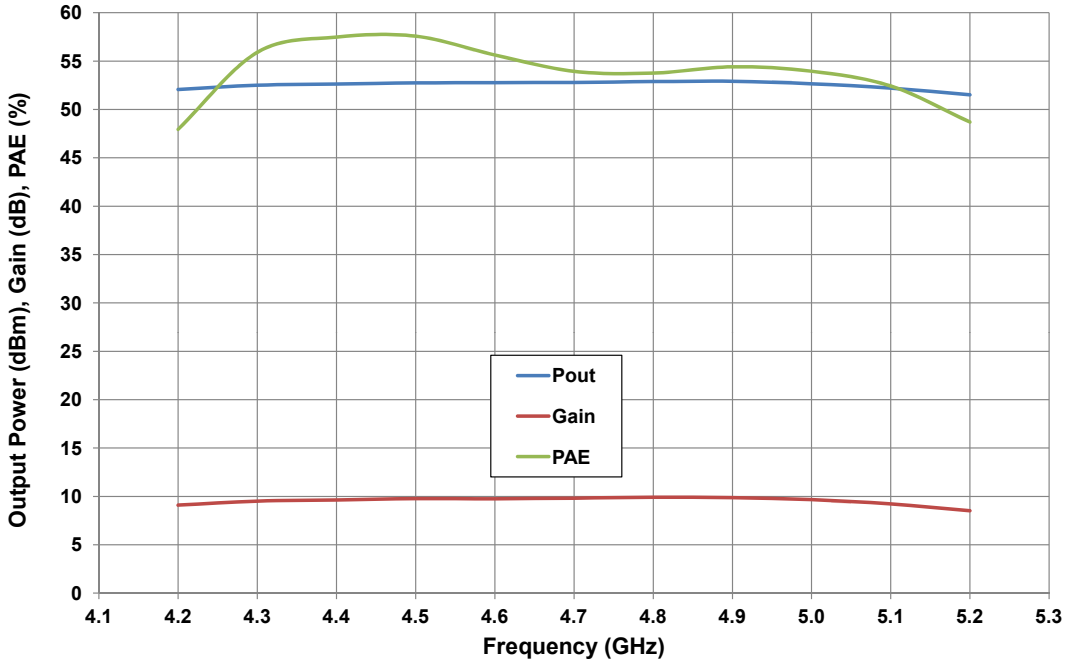
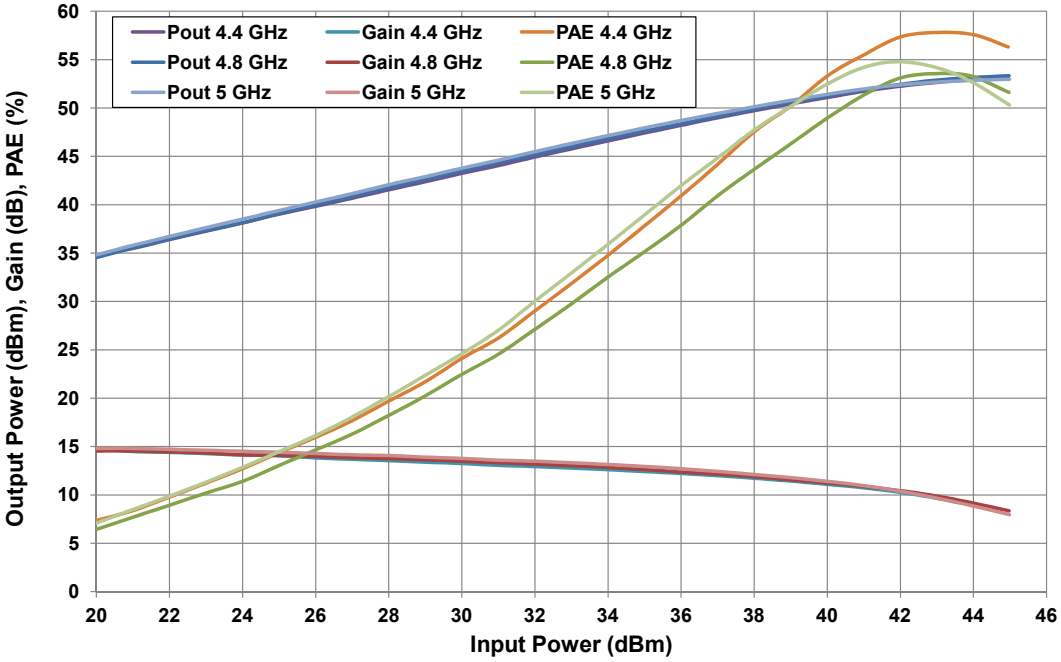


Figure 10. - CW Power Sweep
CGHV50200F in Test Fixture
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C



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Typical Performance

Figure 11. - Pulsed vs Frequency @ P_{IN} = 43 dBm
CGHV50200F in Test Fixture
10% Duty, 100 uS Pulse Width
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C

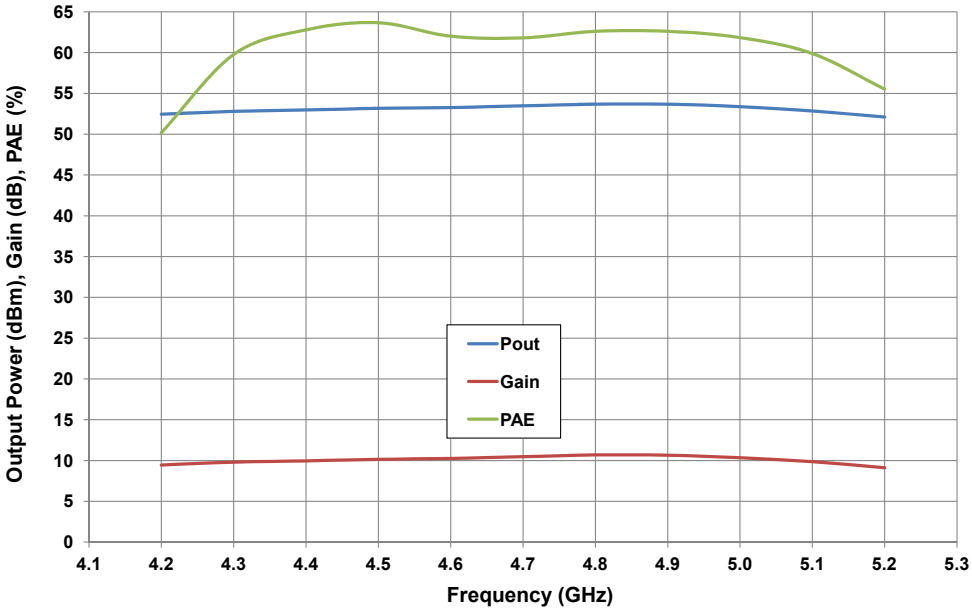
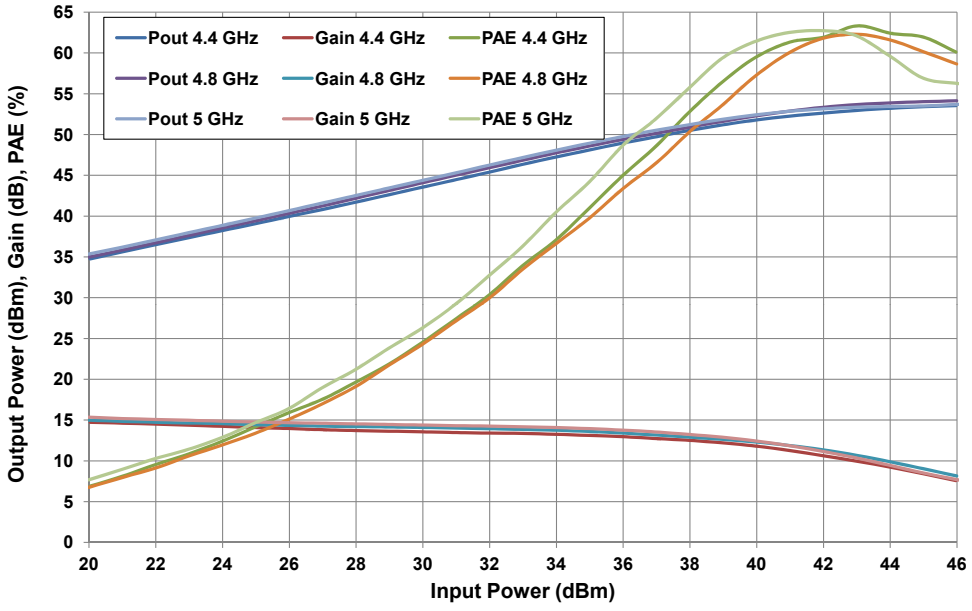


Figure 12. - Pulsed Power Sweep
CGHV50200F in Test Fixture
10% Duty, 100 uS Pulse Width
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C



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Typical Performance

Figure 13. - AM-AM
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C

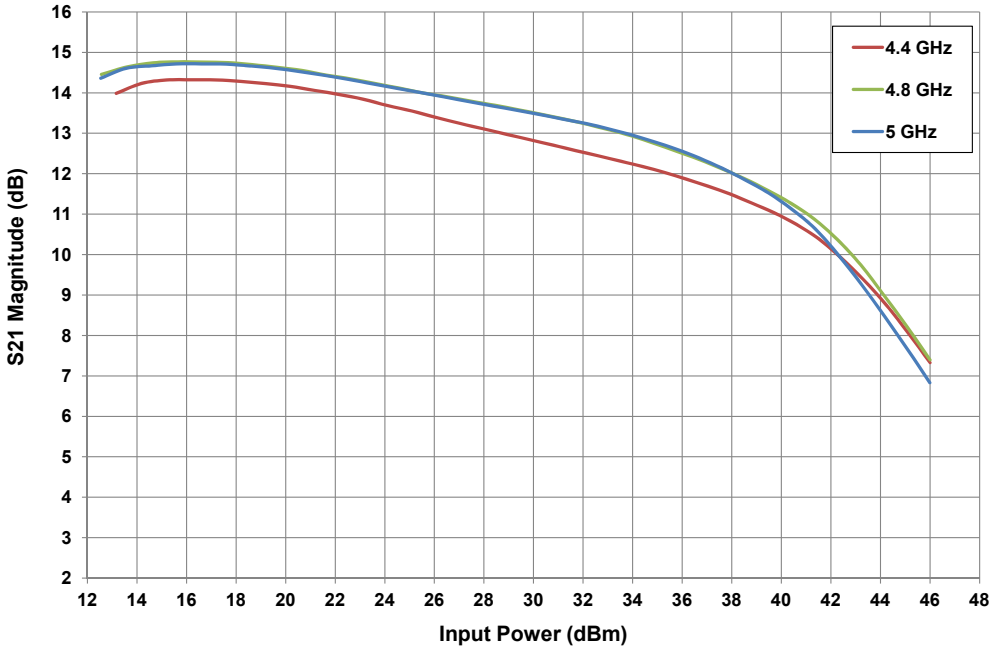
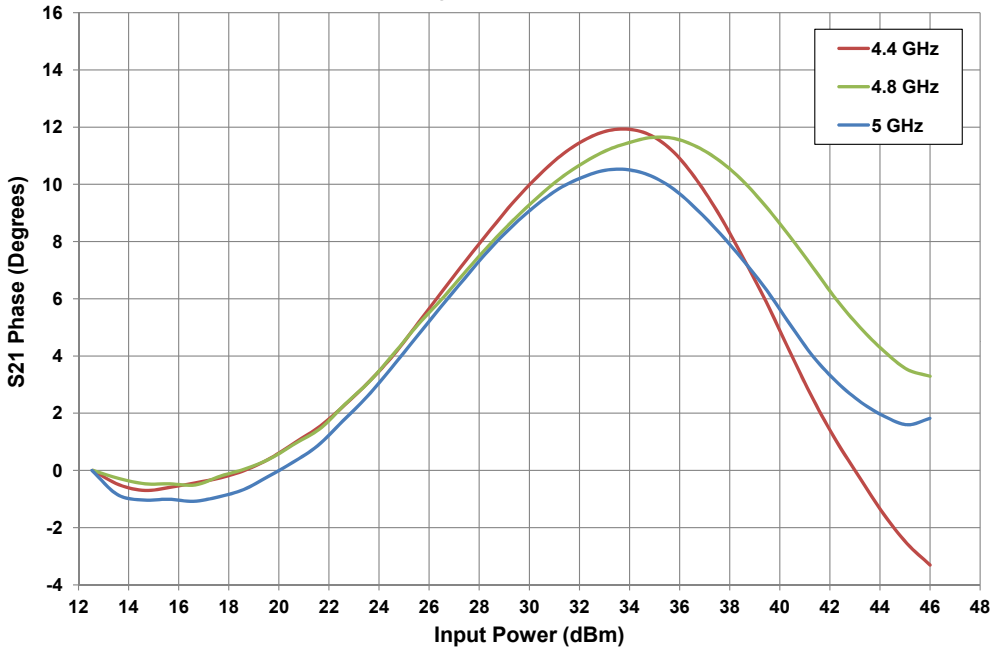


Figure 14. - AM-PM
V_{DD} = 40 V, I_{DQ} = 1 A, Tcase = 25°C



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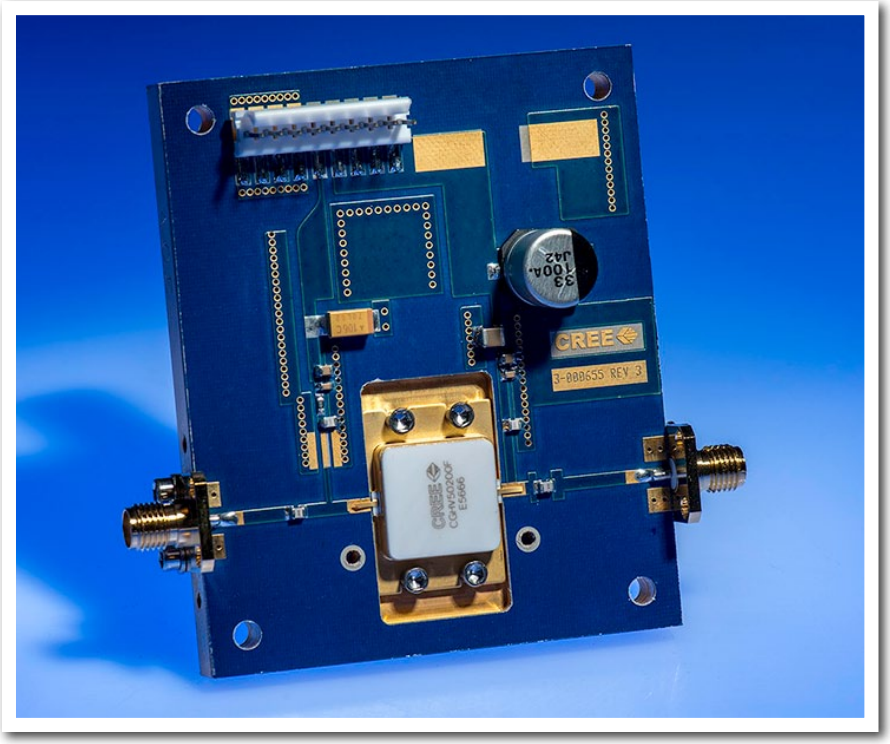
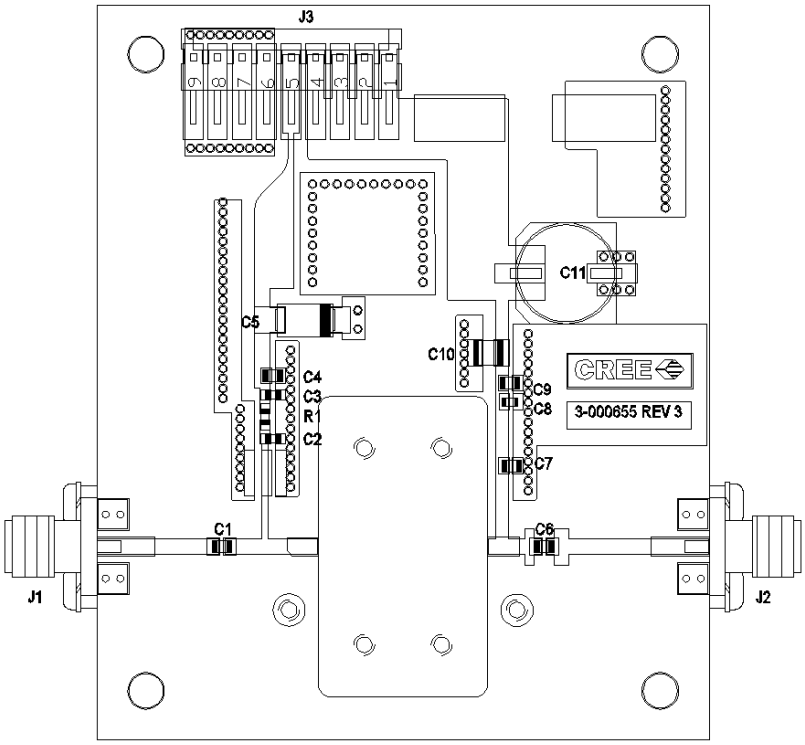
CGHV50200F-TB Demonstration Amplifier Circuit



CGHV50200F-TB Demonstration Amplifier Circuit Outline



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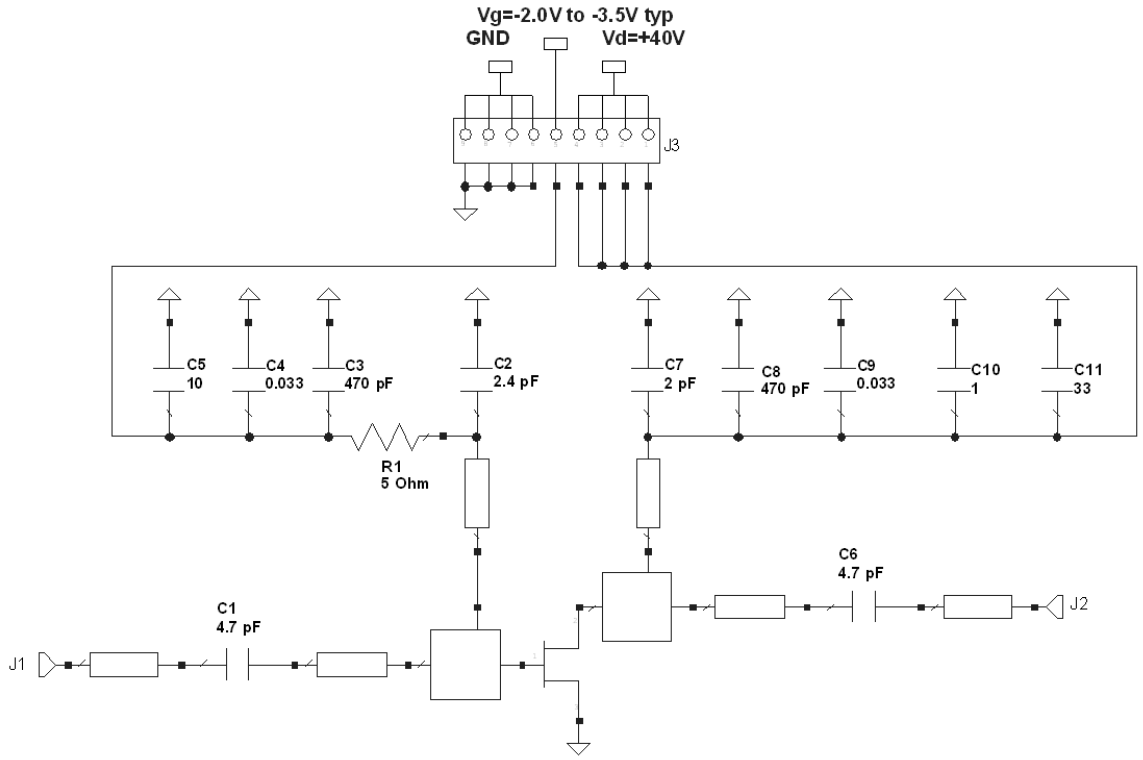
CGHV50200F-TB Demonstration Amplifier Circuit Schematic



CGHV50200F-TB 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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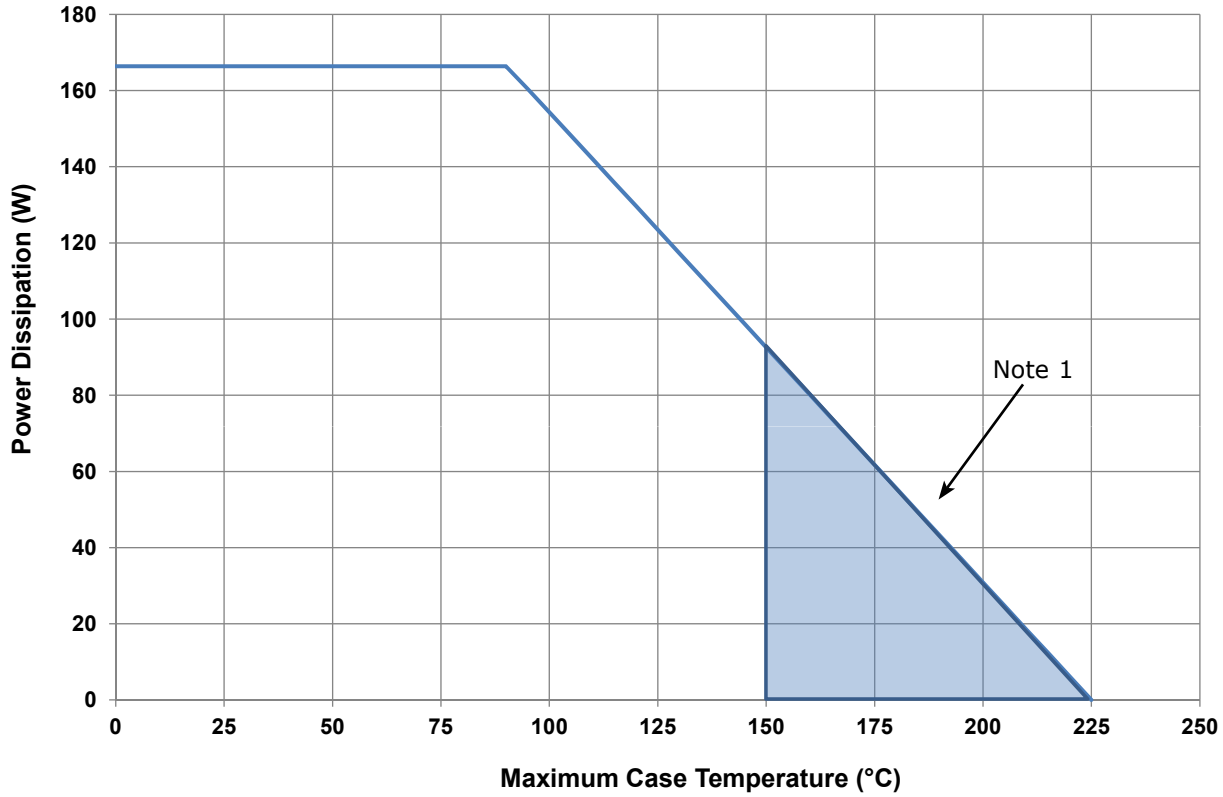
CGHV50200F Power Dissipation De-rating Curve



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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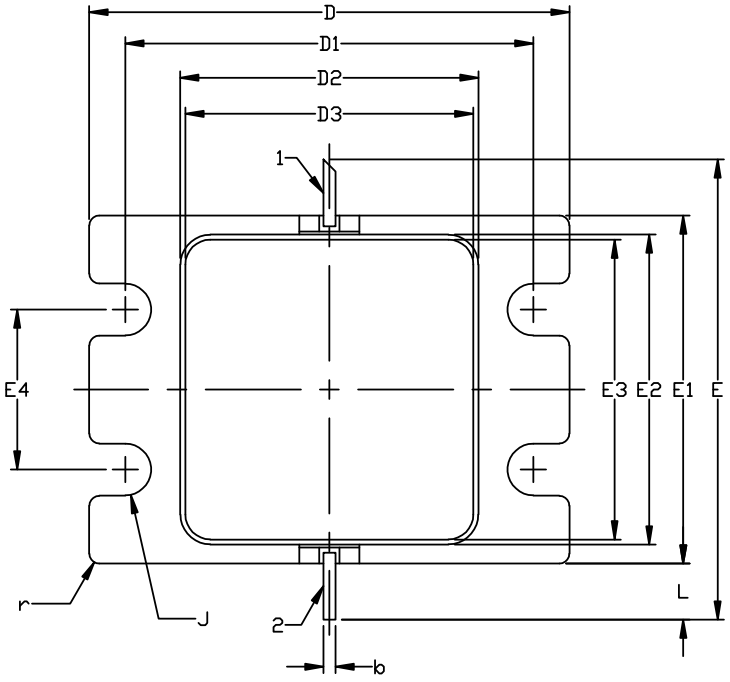
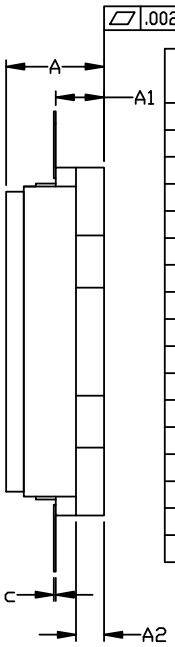
Product Dimensions CGHV50200F (Package Type — 440215)

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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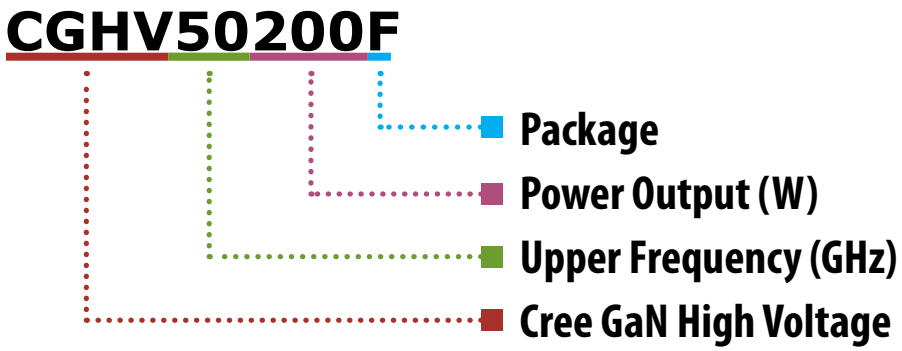
Part Number System



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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