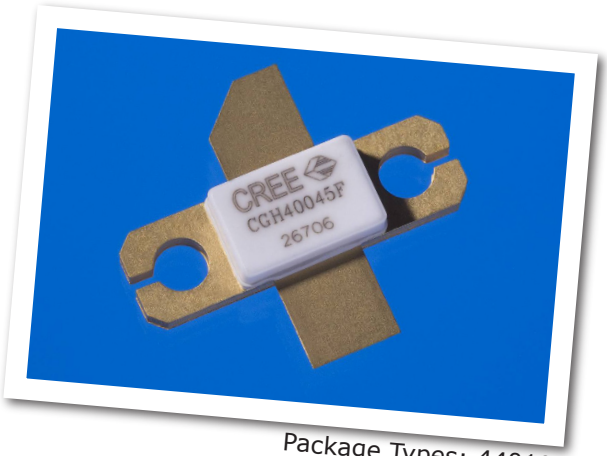
PRELIMINARY

CGH40045

45 W, RF Power GaN HEMT

Cree's CGH40045 is an unmatched, gallium nitride (GaN) high electron mobility transistor (HEMT). The CGH40045, operating from a 28 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 CGH40045 ideal for linear and compressed amplifier circuits. The transistor is available in a flange package.



Package Types: 440193
PN: CGH40045F

FEATURES

- Up to 4 GHz Operation
- >16 dB Small Signal Gain at 2.0 GHz
- 12 dB Small Signal Gain at 4.0 GHz
- 55 W Typical P_{3dB}
- 55 % Efficiency at P3dB
- 28 V Operation

APPLICATIONS

- 2-Way Private Radio
- Broadband Amplifiers
- Cellular Infrastructure
- Test Instrumentation
- Class A, AB, Linear amplifiers suitable for OFDM, W-CDMA, EDGE, CDMA waveforms

RoHS COMPLIANT

Rev 2.2 – May 2008

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

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DSS}	84	Volts
Gate-to-Source Voltage	V_{GS}	-10, +2	Volts
Storage Temperature	T_{STG}	-55, +150	˚C
Operating Junction Temperature	T_J	175	˚C
Maximum Forward Gate Current	I_{GMAX}	15	mA
Soldering Temperature	T_S	225	˚C
Screw Torque	T	80	in-oz
Thermal Resistance, Junction to Case [1]	$R_{\theta JC}$	2.7	˚C/W

Note:
[1] Measured for the CGH40045F at 43W P_{DISS}.

Electrical Characteristics (T_C = 25˚C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[2]						
Gate Threshold Voltage	$V_{GS(th)}$	-3.0	-2.5	-1.8	VDC	V_{DS} = 10 V, I_D = 14.4 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.3	–	VDC	V_{DS} = 28 V, I_D = 400 mA
Saturated Drain Current[3]	I_{DS}	9.6	10.8	–	A	V_{DS} = 6.0 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BR}	84	100	–	VDC	V_{GS} = -8 V, I_D = 14.4 mA
Case Operating Temperature[4]	T_C	-10	–	+60	˚C	P_{DISS} = 43 W
RF Characteristics (T_C = 25˚C, F_0 = 2.5 GHz unless otherwise noted)						
Small Signal Gain	G_{SS}	12.5	14	–	dB	V_{DD} = 28 V, I_{DQ} = 400 mA
Power Output at 3 dB Compression	P_{3dB}	45	55	–	W	V_{DD} = 28 V, I_{DQ} = 400 mA
Drain Efficiency[1]	η	45	55	–	%	V_{DD} = 28 V, I_{DQ} = 400 mA, P_{OUT} = P_{3dB}
Output Mismatch Stress	VSWR	–	TBD	–	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 400 mA, P_{OUT} = 45 W CW
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	19.3	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	4.6	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	1.7	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz

Notes:
[1] Drain Efficiency = P_{OUT} / P_{DC}
[2] Measured on wafer prior to packaging.
[3] Scaled from PCM data.
[4] See also, the Power Dissipation De-rating Curve on Page 4.

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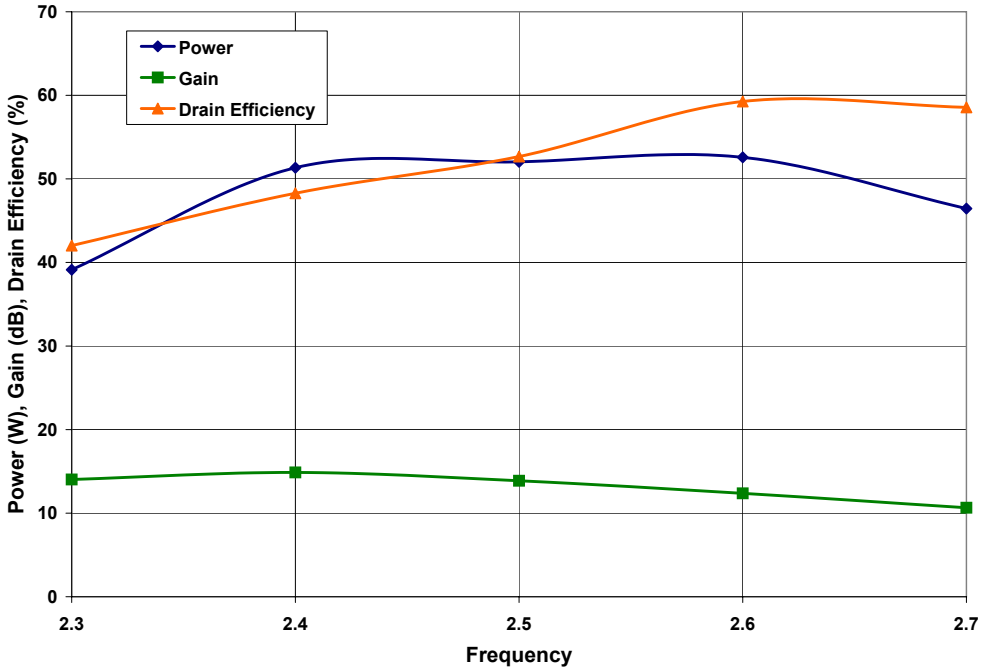
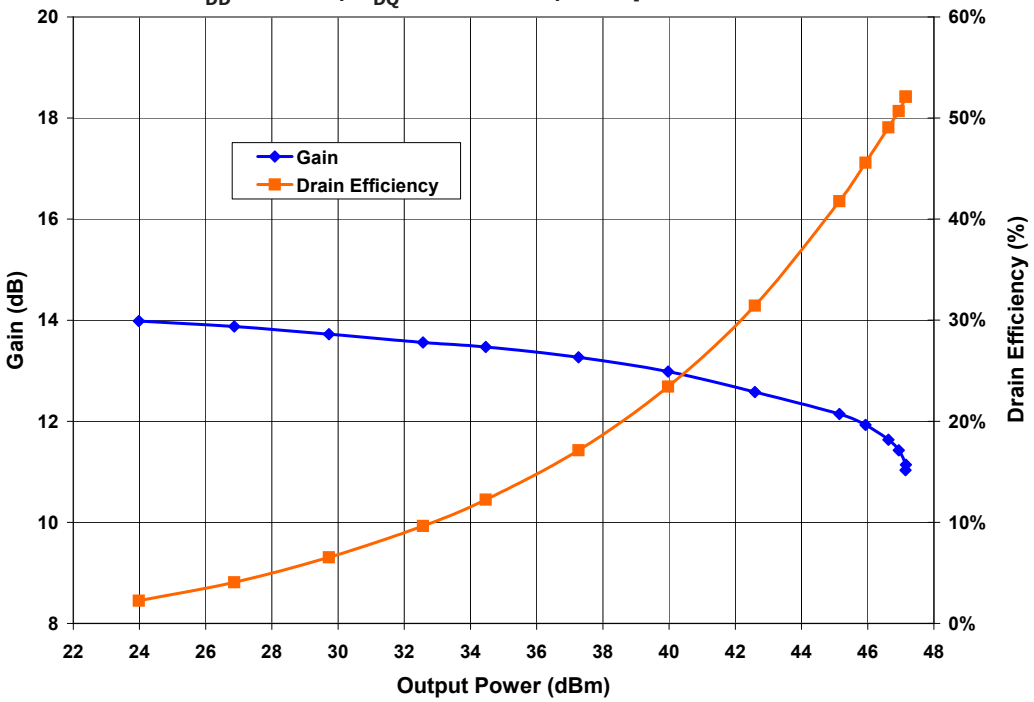
Typical Performance

Gain, Efficiency, and Output Power vs Frequency of the CGH40045F measured in Amplifier Circuit CGH40045F-TB
V_{DD} = 28 V, I_{DQ} = 400 mA, Freq = 2.3 - 2.7 GHz



Gain and Efficiency vs Output Power of the CGH40045F measured in Amplifier Circuit CGH40045F-TB
V_{DD} = 28 V, I_{DQ} = 400 mA, Freq = 2.5 GHz



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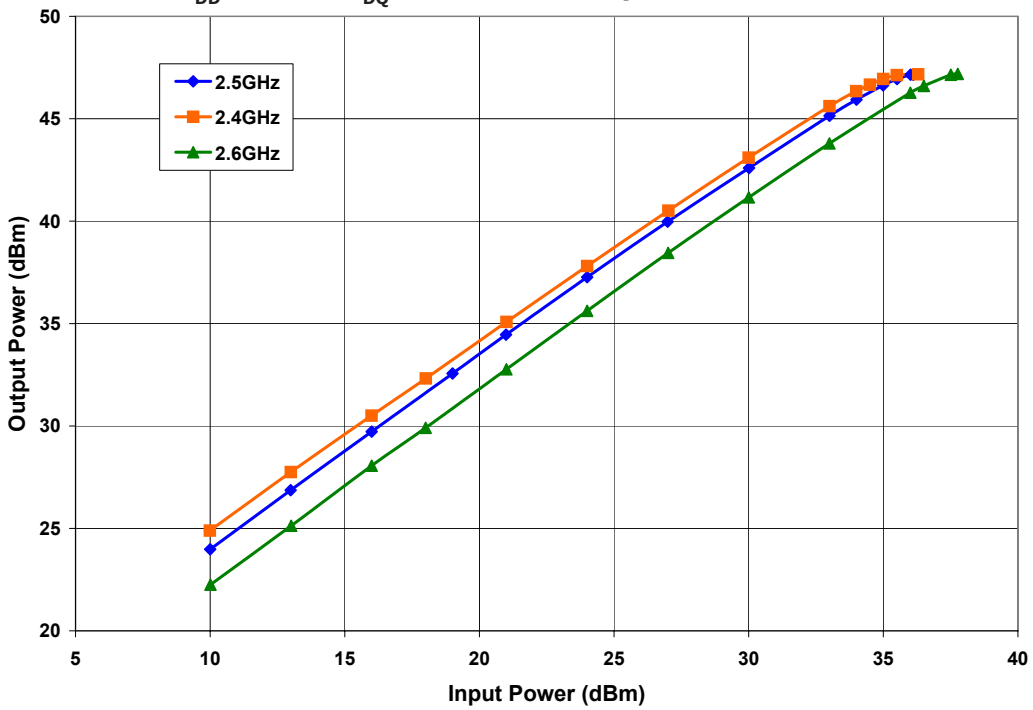
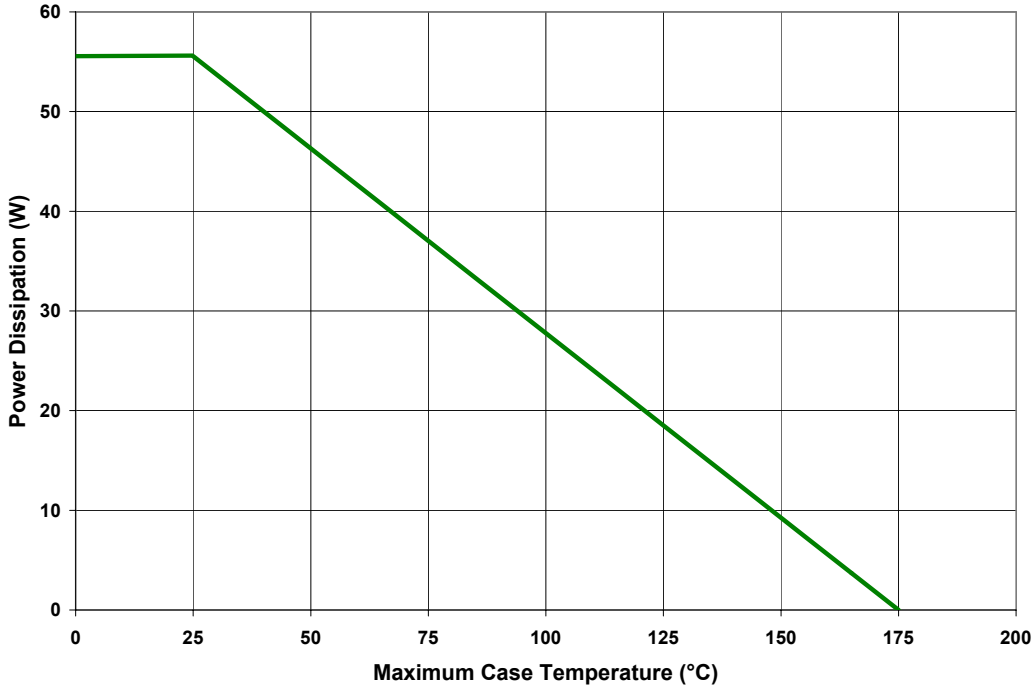
Typical Performance

Single Tone CW Gain, Efficiency, and Output Power vs Input Power of the CGH40045F measured in an Amplifier Circuit
V_{DD} = 28 V, I_{DQ} = 400 mA, Freq = 2.3 - 2.7 GHz



CGH40045F Power Dissipation De-rating Curve



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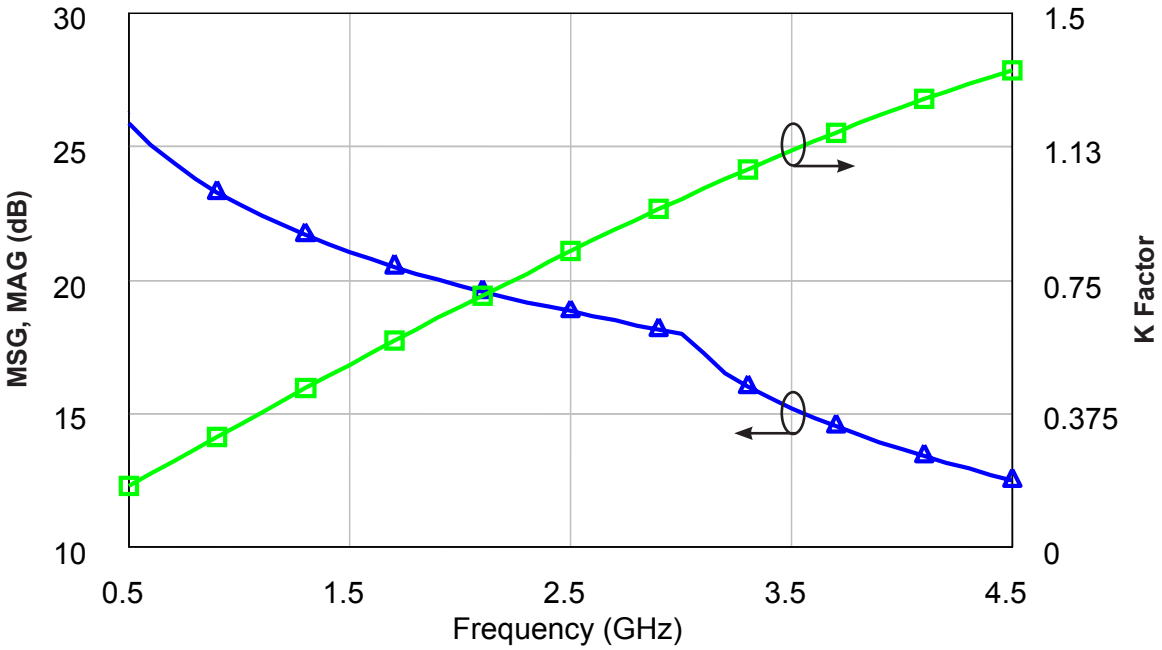
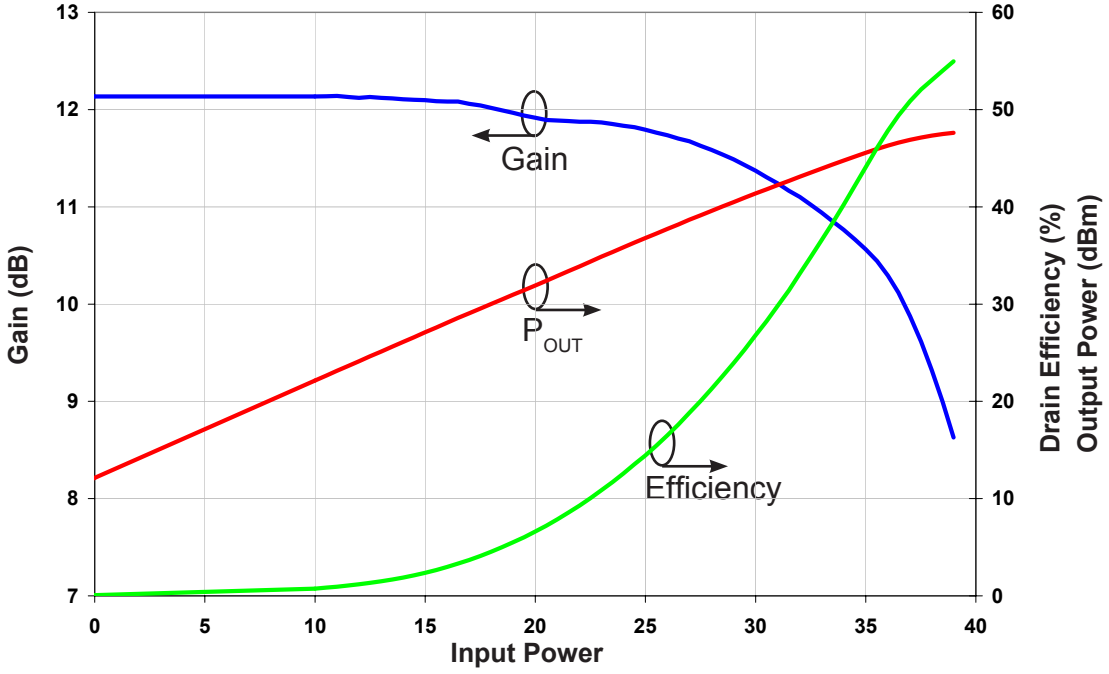
Typical Performance

Simulated Maximum Stable Gain, Maximum Available Gain and K Factor of the CGH40045F
V_{DD} = 28 V, I_{DQ} = 800 mA



Single Tone CW Gain, Efficiency, and Output Power vs Input Power of the CGH40045F measured in an Amplifier Circuit
V_{DD} = 28 V, I_{DQ} = 800 mA, Freq = 3.6 GHz



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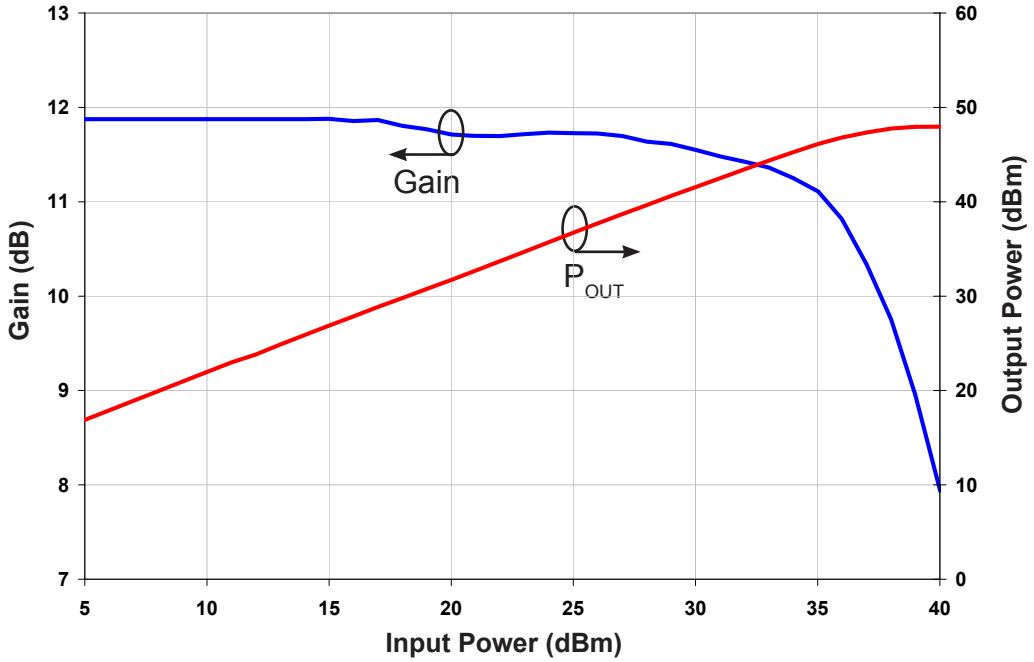
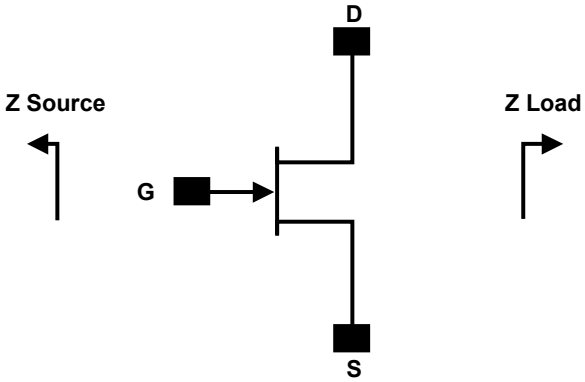
Typical Performance

Pulsed Gain and Output Power vs Input Power of the CGH40045F measured in an Amplifier Circuit
V_{DD} = 28 V, I_{DQ} = 800 mA, Freq = 3.6 GHz, Pulse Width=200µS, 10% Duty Cycle



Simulated Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
500	3.34 + j4.56	10.8 + j8.24
1000	2.07 + j0.05	6.18 + j4.17
2000	1.3 – j3.37	4.65 + j0.05
3000	1.64 – j8.15	4.75 – j3.4
4000	1.9 – j10.8	4.56 – j7.9

Note 1. V_{DD} = 28V, I_{DQ} = 800mA in the 440193 package.
Note 2. Optimized for P_{3dB} and Drain Efficiency

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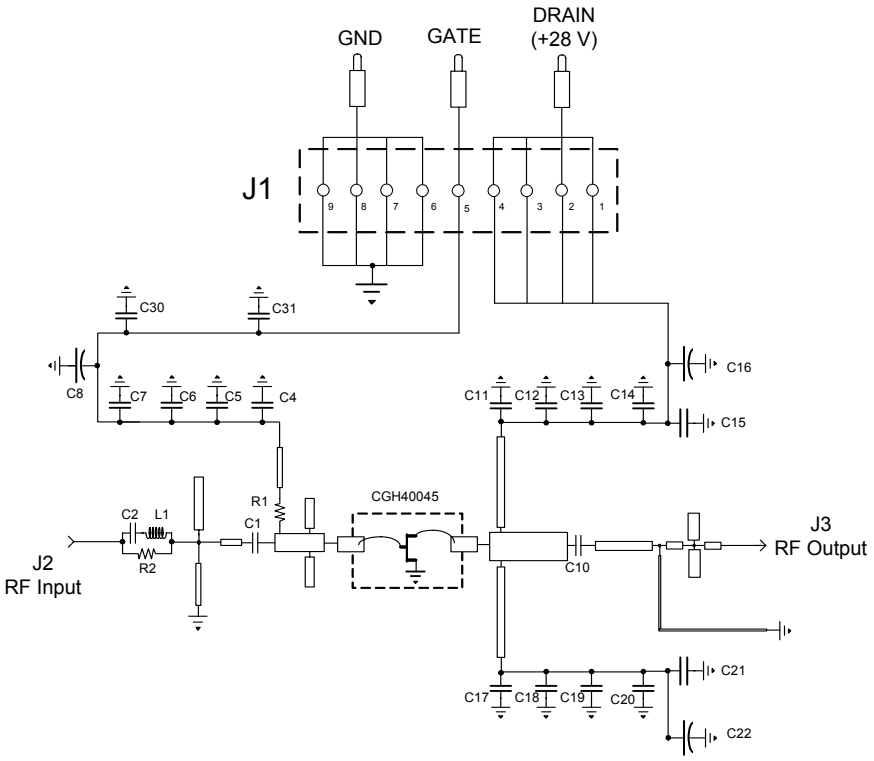
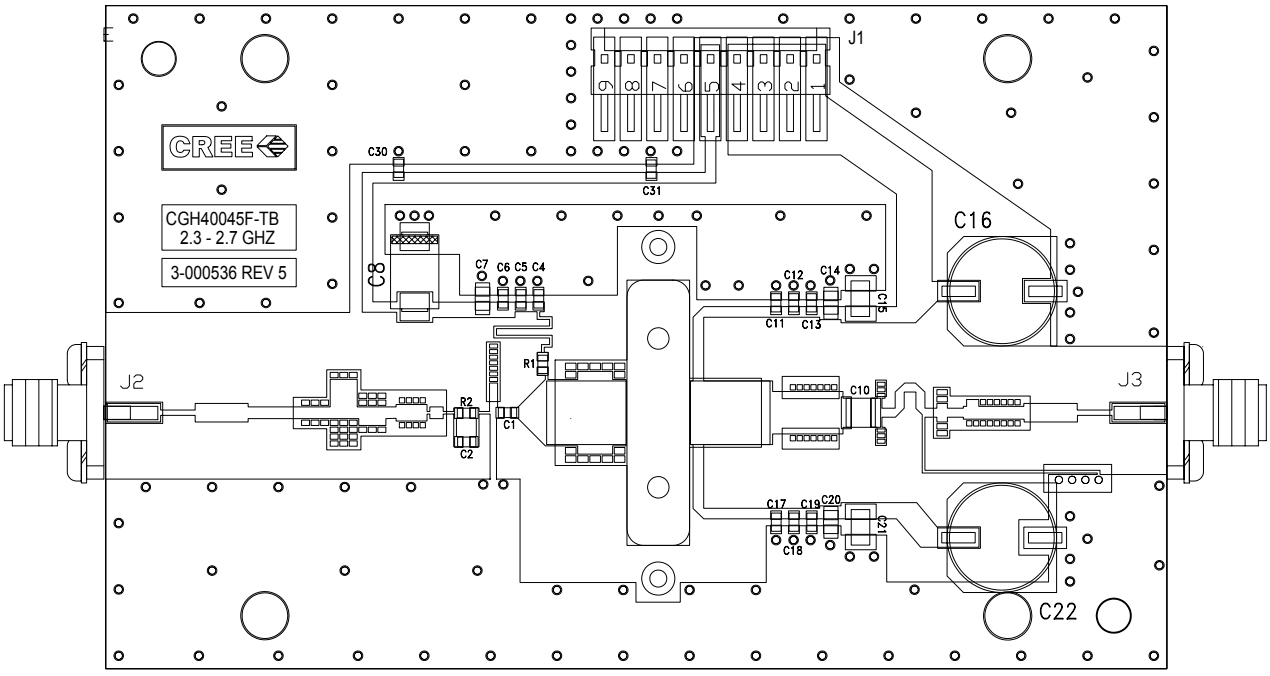
CGH40045F-TB Demonstration Amplifier Circuit Schematic



CGH40045F-TB Demonstration Amplifier Circuit Outline



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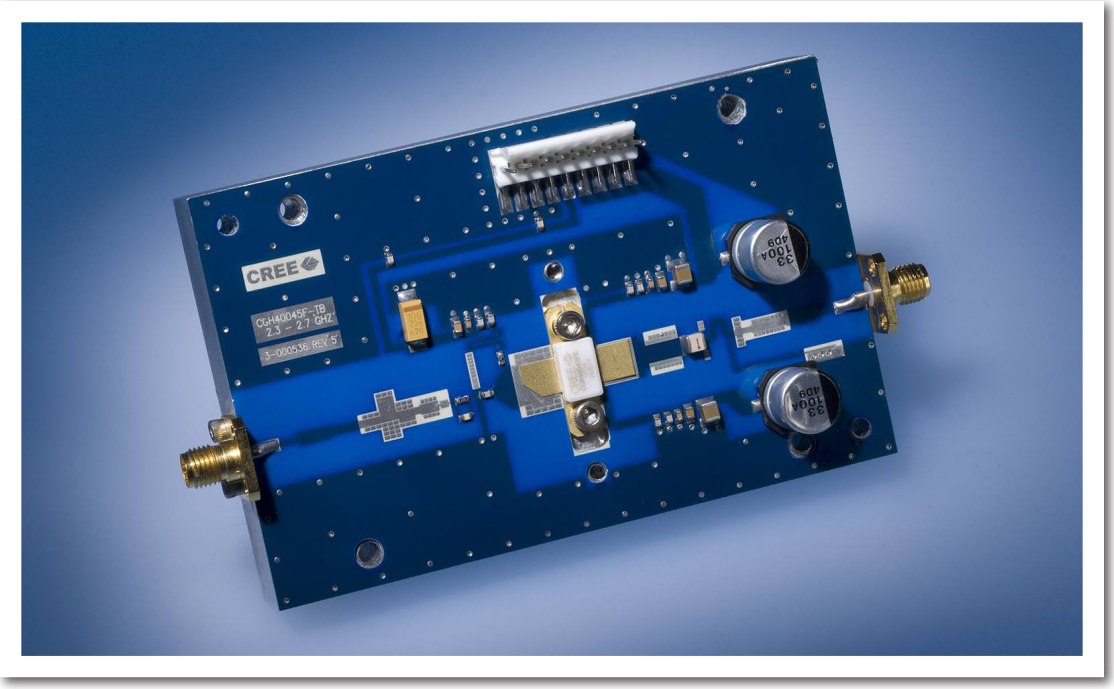
CGH40045F-TB Demonstration Amplifier Circuit



CGH40045F-TB Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
C1	CAP, 6.8pF, ± -0.25 pF, 0603	1
C2	CAP, 1.8pF, ± -0.1 pF, 0603	1
C3,C10	CAP, 5.6pF, ± -0.1pF, 0603	2
C12	CAP, 10000pF, 100V, TEMP STBL, 0805	1
C6,C13	CAP, 0.1uF ±10%, 100 V, 1206, X7R	2
C4,C11	CAP, 100pF±5%, 0603	2
C8	CAP, 10UF, 16V, SMT, TANTALUM	1
C9	CAP, 0.2pF, ± -0.05pF, 0603	1
C7,C14	CAP, 1.0UF ±10%, 100V, 1210, X7R	2
C5,C15,C18,C30,C31	CAP, 82.0pF, ±5%, 0603	5
C16	CAP, 4.7pF, ± 0.25pF, 0603	1
R2	RES, 1/16W, 0603, 100 Ohms 1%	1
R1	RES, 1/16W, 0603, 5.1 Ohms 1%	1
L1	FERRITE, 220 OHM, 0805	1
L2	FERRITE, 22 OHM, 0805	1
J2,J3	CONN, SMA, PANEL MOUNT JACK, FLANGE	2
J1	CONN, HEADER, RT>PLZ .1CEN LK 9POS	1
Q1	CGH40045	1

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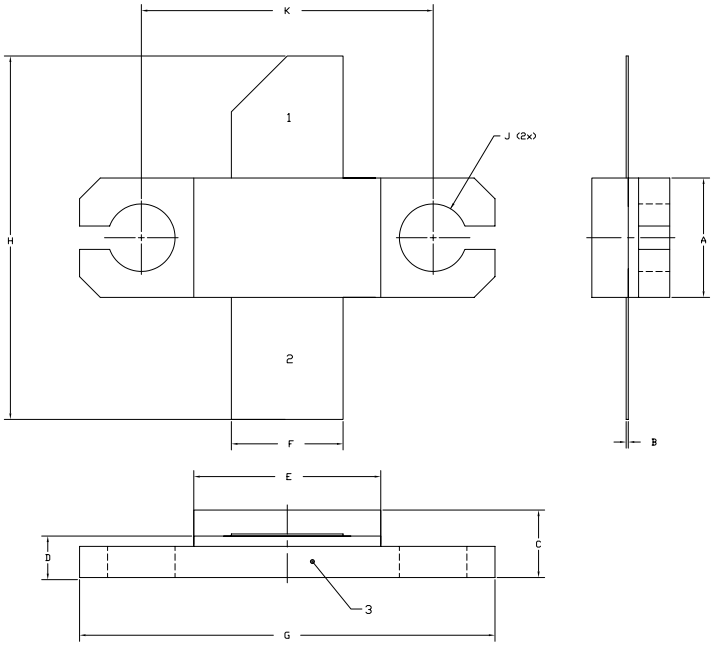
Product Dimensions CGH40045F (Package Type — 440193)



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

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.225	0.235	5.72	5.97
B	0.004	0.006	0.10	0.15
C	0.125	0.135	3.18	3.43
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

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