CGH40006P

6 W, RF Power GaN HEMT

Cree's CGH40006 is an unmatched, gallium nitride (GaN) high electron mobility transistor (HEMT). The CGH40006, 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 CGH40006 ideal for linear and compressed amplifier circuits. The transistor is available in solder-down, pill packages.

Package Types: 440109
PN's: CGH40006P

FEATURES

- Up to 6 GHz Operation
- 13 dB Small Signal Gain at 2.0 GHz
- 11 dB Small Signal Gain at 6.0 GHz
- 8 W typical at P_{IN} = 32 dBm
- 65 % Efficiency at P_{IN} = 32 dBm
- 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

Large Signal Models Available for SiC & GaN

PRELIMINARY
Rev 0.1 – December 2009

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	225	˚C
Maximum Forward Gate Current	I_{GMAX}	2.1	mA
Soldering Temperature[1]	T_S	245	˚C
Screw Torque	τ	60	in-oz
Thermal Resistance, Junction to Case[2]	$R_{\theta JC}$	9.5	˚C/W
Case Operating Temperature[2]	T_C	-40, +85	˚C

Note:
[1] Refer to the Application Note on soldering at www.cree.com/products/wireless_appnotes.asp
[2] Measured for the CGH40006P at P_{DISS} = 8 W.

Electrical Characteristics (T_C = 25˚C)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1]						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.3	-2.3	VDC	V_{DS} = 10 V, I_D = 2.1 mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-3.0	–	VDC	V_{DS} = 28 V, I_D = 100 mA
Saturated Drain Current	I_{DS}	2.9	3.5	–	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 = 2.1 mA
RF Characteristics[2] (T_C = 25˚C, F_0 = 2.0 GHz unless otherwise noted)						
Small Signal Gain	G_{SS}	–	12	–	dB	V_{DD} = 28 V, I_{DQ} = 100 mA
Power Output at P_{IN} = 32 dBm	P_{OUT}	–	8	–	W	V_{DD} = 28 V, I_{DQ} = 100 mA
Drain Efficiency[3]	η	–	65	–	%	V_{DD} = 28 V, I_{DQ} = 100 mA, P_{IN} = 32 dBm
Output Mismatch Stress	VSWR	–	10 : 1	–	Ψ	No damage at all phase angles, V_{DD} = 28 V, I_{DQ} = 100 mA, P_{IN} = 32 dBm
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	2.63	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	1.08	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	0.14	–	pF	V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz

Notes:
[1] Measured on wafer prior to packaging.
[2] Measured in CGH40006P-TB.
[3] Drain Efficiency = P_{OUT} / P_{DC}

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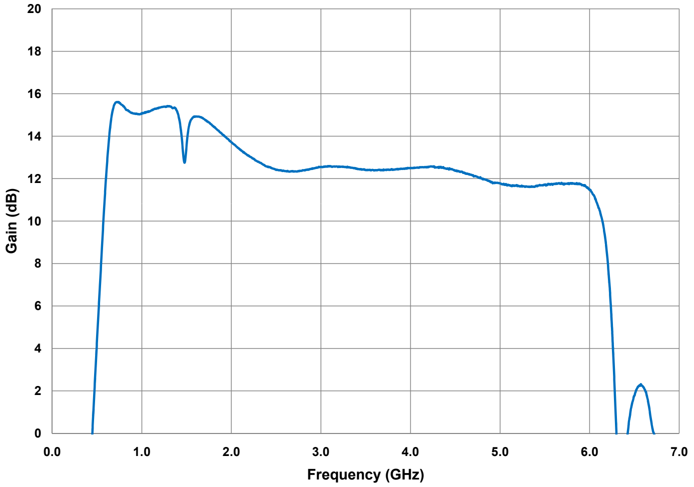
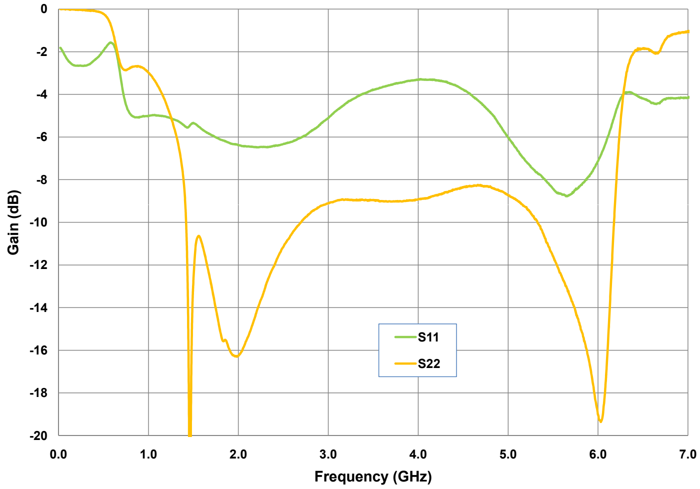
Typical Performance

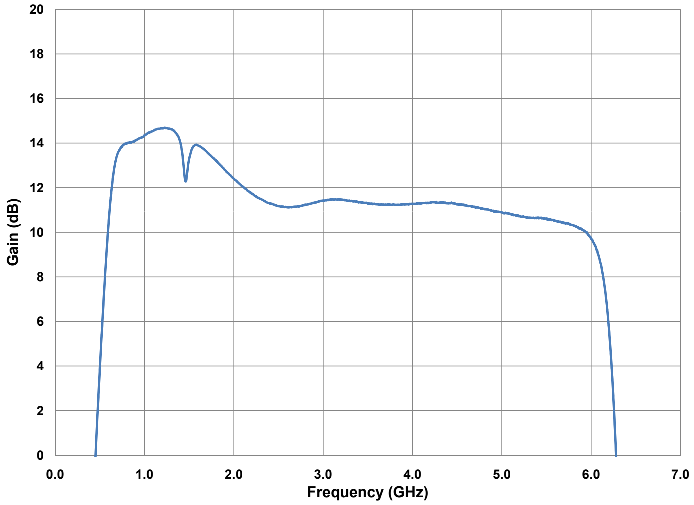
Small Signal Gain vs Frequency at 28 V



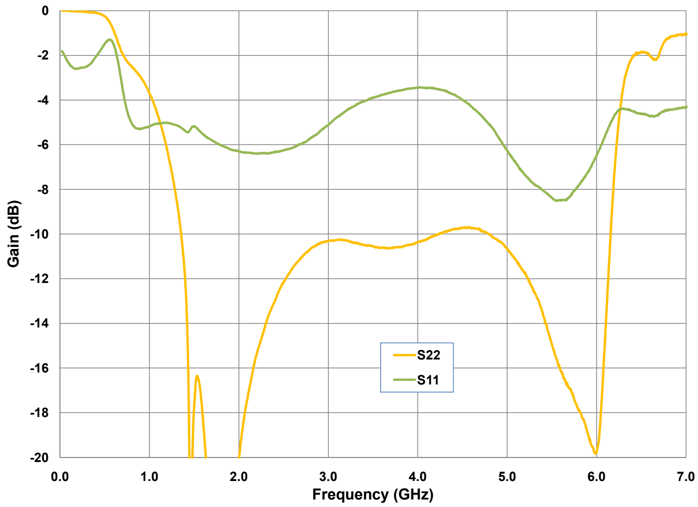
Input & Output Return Losses vs Frequency at 28 V



Small Signal Gain vs Frequency at 20 V



Input & Output Return Losses vs Frequency at 20 V



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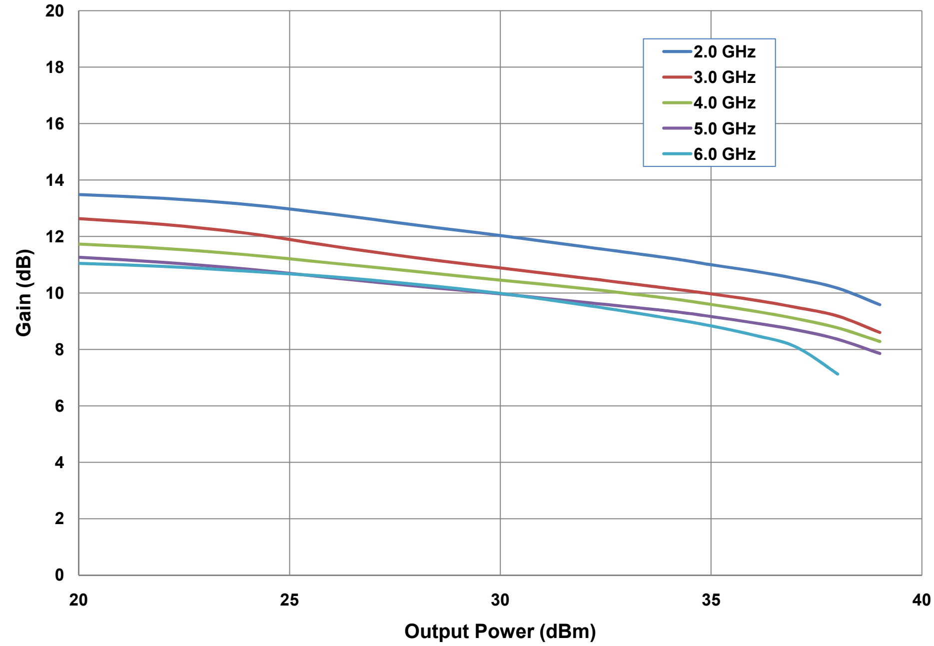
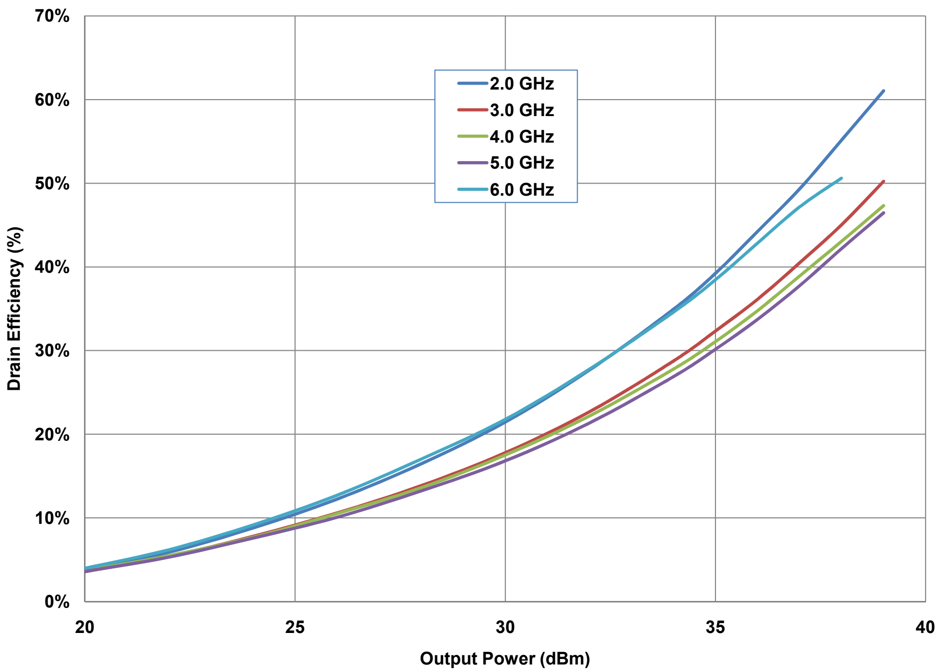
Typical Performance

Power Gain vs Output Power as a Function of Frequency V_{DD} = 28 V, I_{DQ} = 100 mA



Drain Efficiency vs Output Power as a Function of Frequency V_{DD} = 28 V, I_{DQ} = 100 mA



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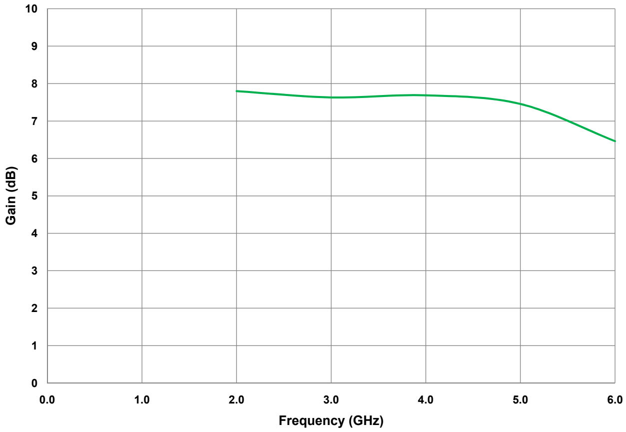
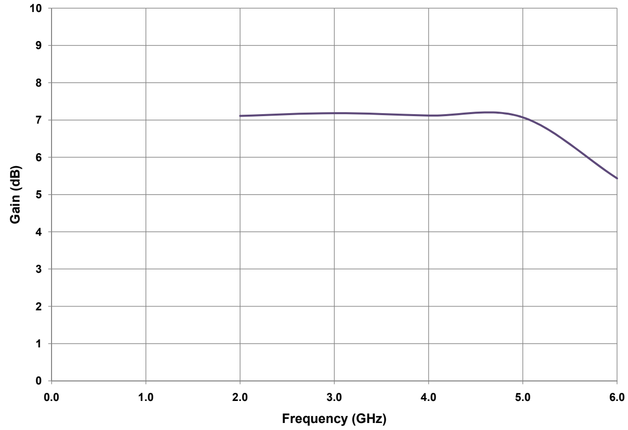
Typical Performance

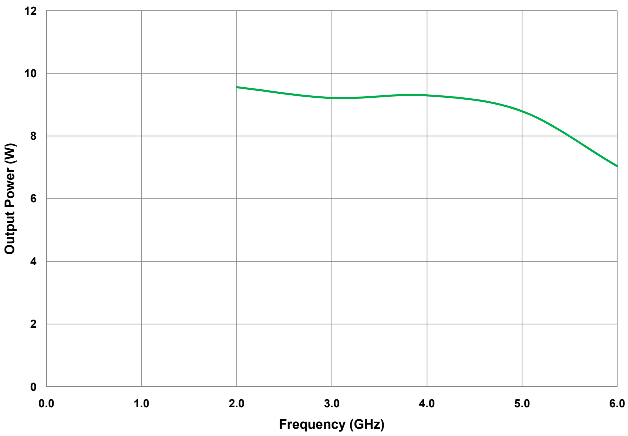
Power Gain vs Frequency at P_{IN} = 32 dBm, V_{DD} = 28 V



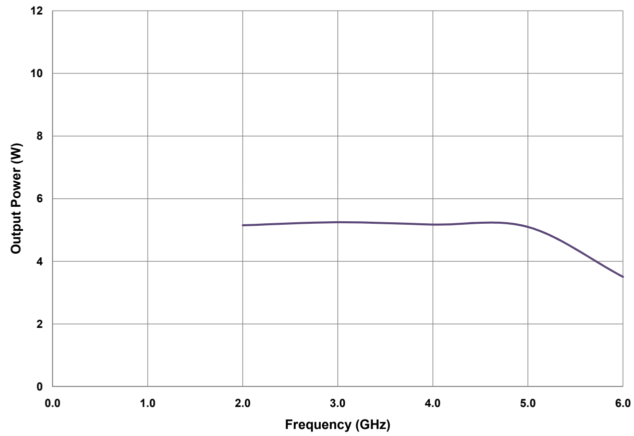
Power Gain vs Frequency at P_{IN} = 30 dBm, V_{DD} = 20 V



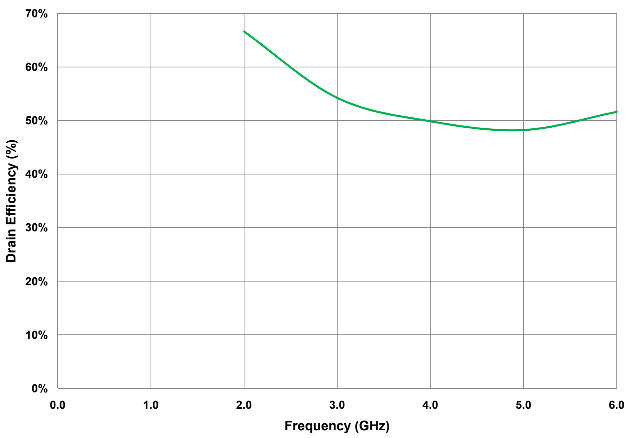
Power Output vs Frequency at P_{IN} = 32 dBm, V_{DD} = 28 V



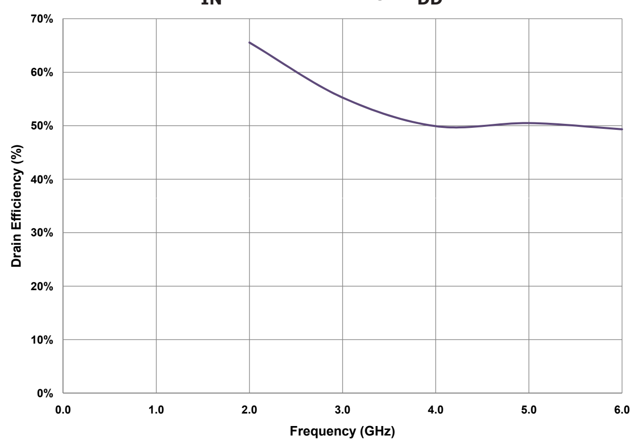
Power Output vs Frequency at P_{IN} = 30 dBm, V_{DD} = 20 V



Drain Efficiency vs Frequency at P_{IN} = 32 dBm, V_{DD} = 28 V



Drain Efficiency vs Frequency at P_{IN} = 30 dBm, V_{DD} = 20 V



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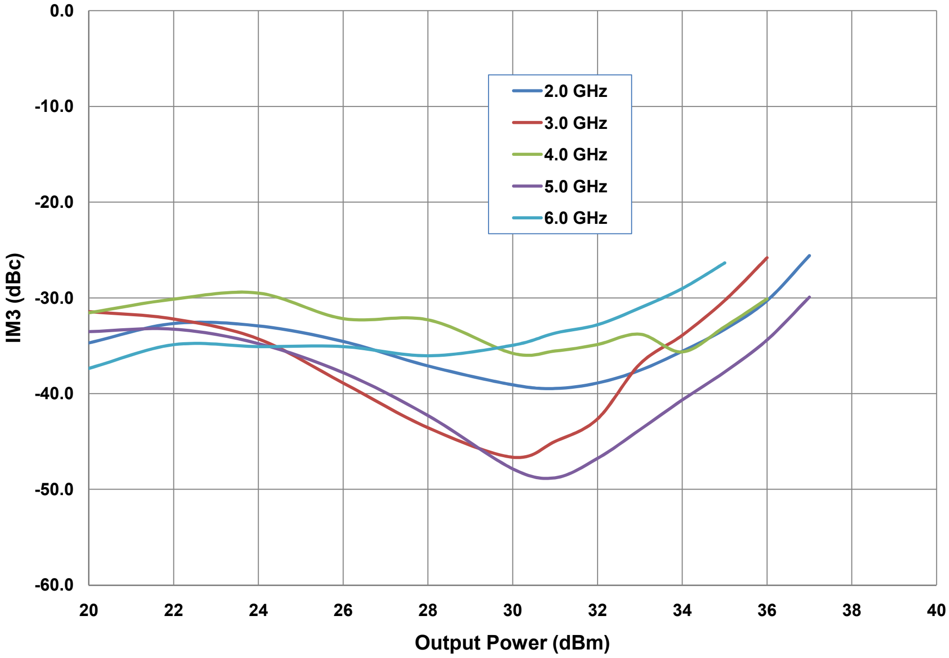
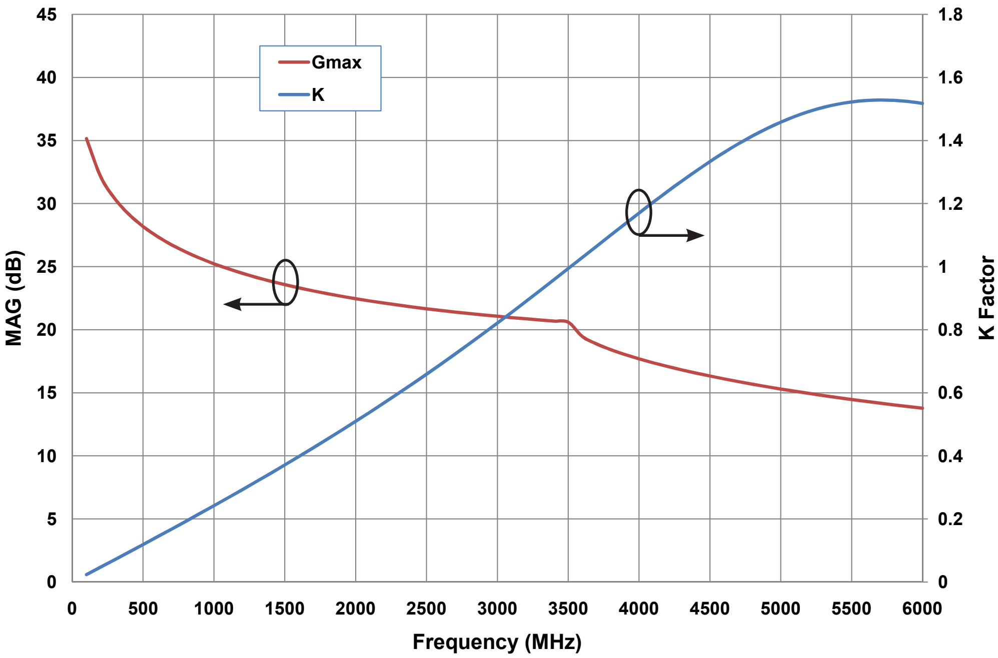
Typical Performance

Third Order Intermodulation Distortion vs Total Output Power as a Function of Frequency
V_{DD} = 28 V, I_{DQ} = 60 mA



Simulated Maximum Available Gain and K Factor of the CGH40006P
V_{DD} = 28 V, I_{DQ} = 100 mA



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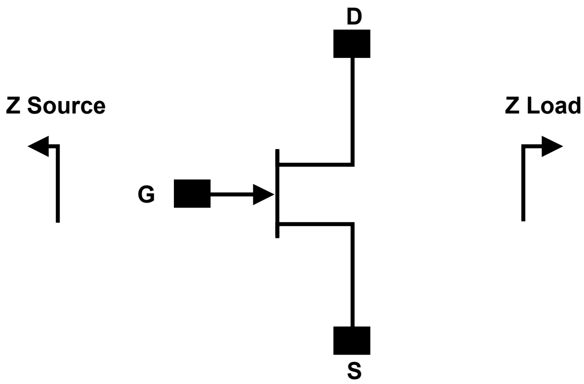
Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
500	TBD	TBD
1000	TBD	TBD
1500	TBD	TBD
2500	TBD	TBD
3500	TBD	TBD

Note 1. V_{DD} = 28V, I_{DQ} = 200mA in the 440109 package.
Note 2. Optimized for P_{SAT} and PAE.
Note 3. When using this device at low frequency, series resistors should be used to maintain amplifier stability.

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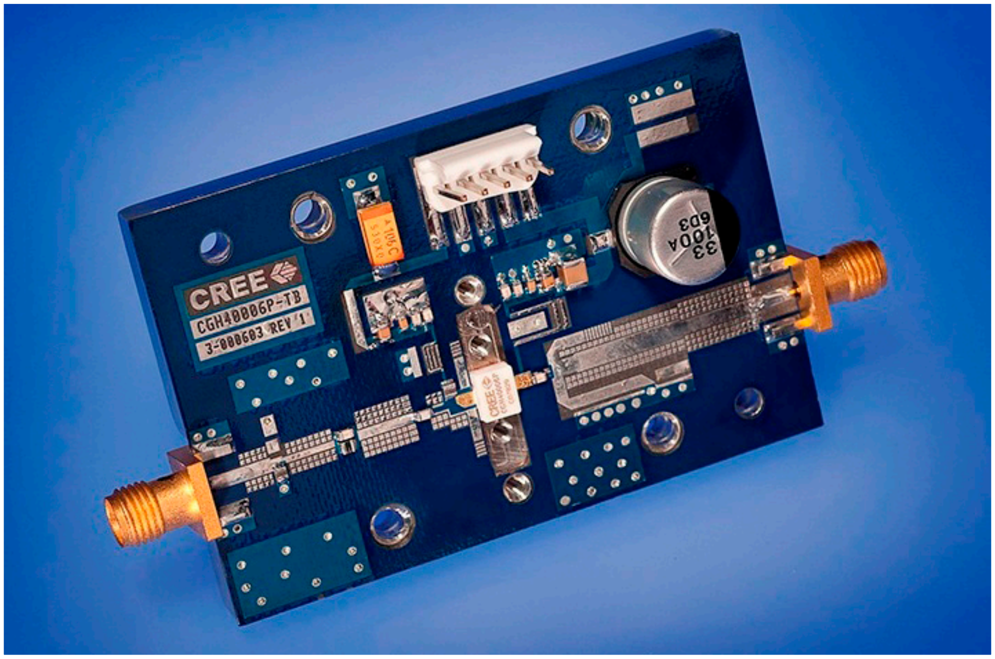
CGH40006P-TB Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, AIN, 0505, 470 Ohms (≤5% tolerance)	1
R2	RES, AIN, 0505, 10 Ohms (≤5% tolerance)	1
R3	RES, AIN, 0505, 150 Ohms (≤5% tolerance)	1
C1	CAP, 2.0 pF +/-0.1 pF, 0603, ATC 600S	1
C2	CAP, 4.7 pF +/-0.25 pF, 0603, ATC 600S	1
C10	CAP, 3.6 pF +/-0.1 pF, 0603, ATC 600S	1
C4,C11	CAP, 8.2 pF +/-0.25, 0603, ATC 600S	2
C6,C13	CAP, 470 pF +/-5%, 0603, 100 V	2
C7,C14	CAP, 33000 pF, CER, 100V, X7R, 0805	2
C8	CAP, 10 uf, 16V, SMT, TANTALUM	1
C15	CAP, 1.0 uF +/-10%, CER, 100V, X7R, 1210	1
C16	CAP, 33 uF, 100V, ELECT, FK, SMD	1
J3,J4	CONN, SMA, STR, PANEL, JACK, RECP	2
J1	HEADER RT>PLZ .1CEN LK 5POS	1
-	PCB, RO5880	1
Q1	CGH40006P	1

CGH40006P-TB Demonstration Amplifier Circuit



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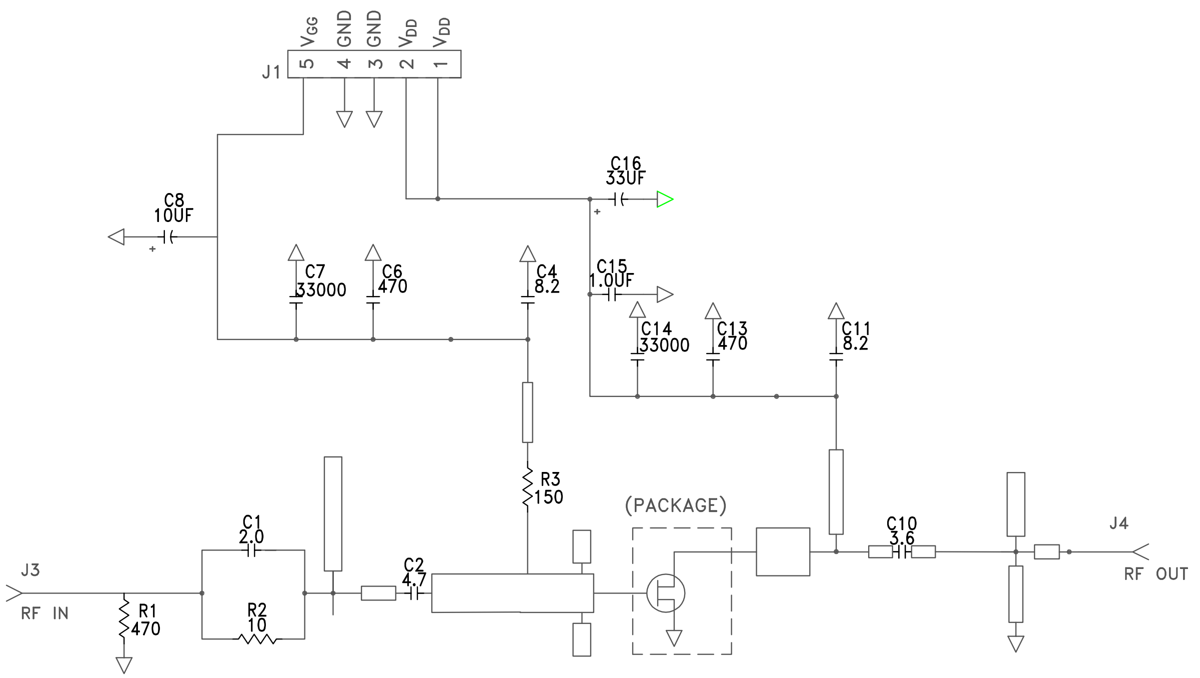
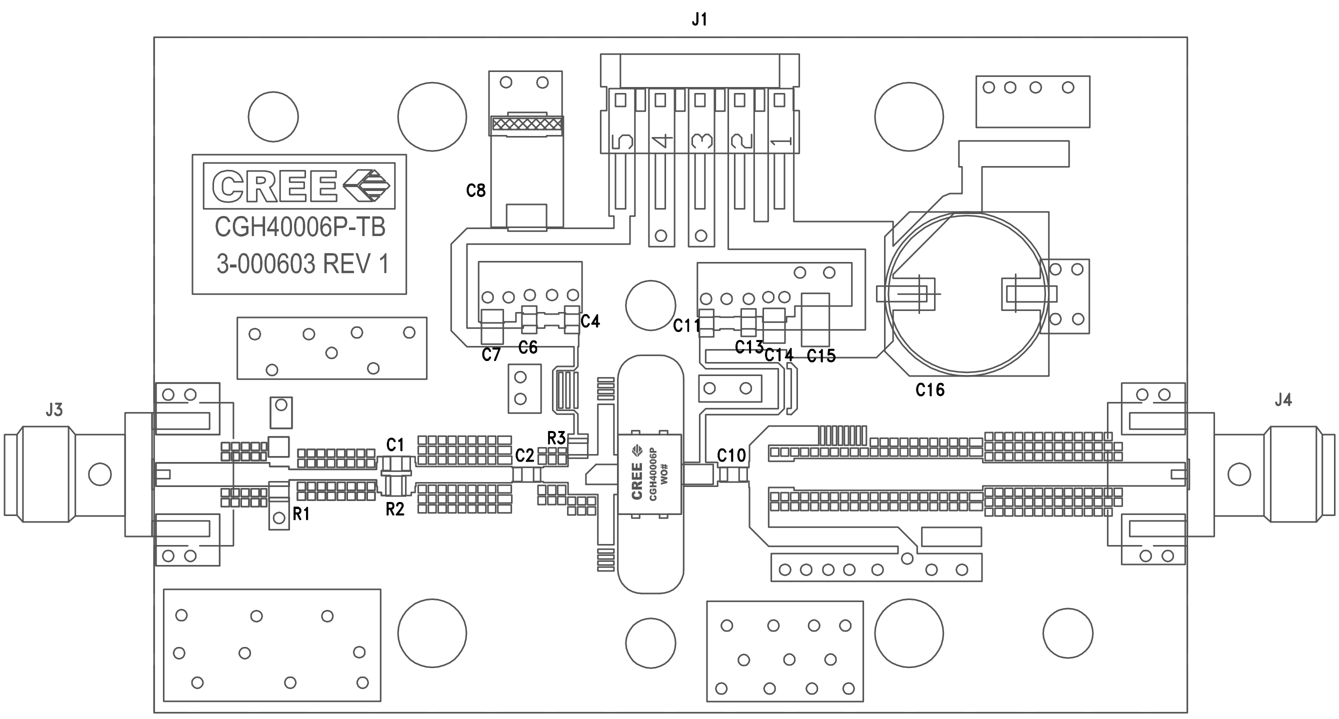
CGH40006P-TB Demonstration Amplifier Circuit Schematic



CGH40006P-TB Demonstration Amplifier Circuit Outline



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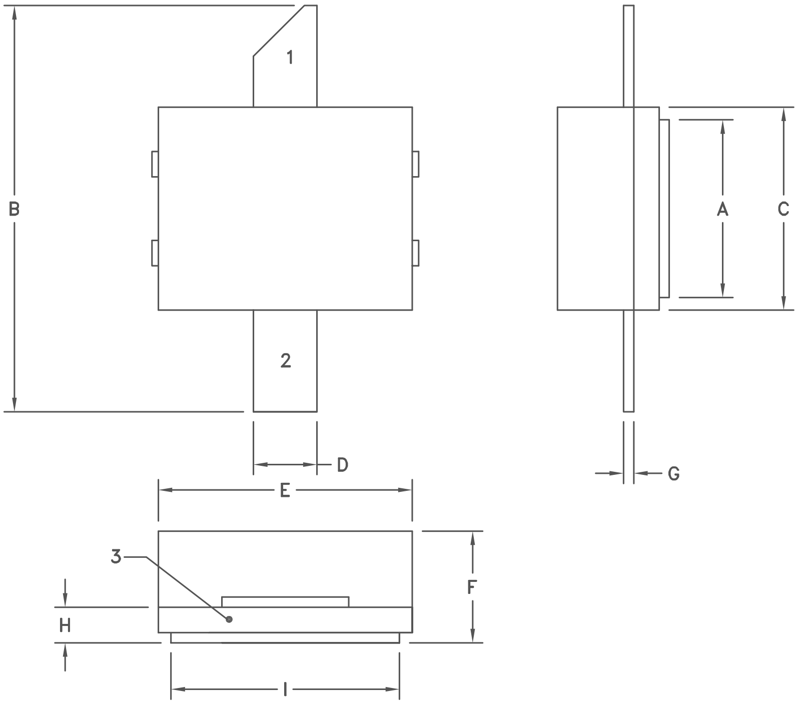
Product Dimensions CGH40006P (Package Type — 440109)



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. INTERPRET DRAWING IN ACCORDANCE WITH ANSI Y14.5M–1982 DIMENSIONING AND TOLERANCING.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.135	.145	3.43	3.68
B	.315	.325	8.00	8.26
C	.155	.165	3.94	4.19
D	.045	.055	1.14	1.40
E	.195	.205	4.95	5.21
F	.090	.110	2.29	2.79
G	.007	.009	.178	0.23
H	.026	.030	.660	.762
I	.175	.185	4.45	4.70

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

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