CGHV40180P

180 W, DC - 2000 MHz, 50 V, GaN HEMT

Cree's CGHV40180P is an unmatched, gallium nitride (GaN) high electron mobility transistor (HEMT). The CGHV40180P, 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 CGHV40180P ideal for linear and compressed amplifier circuits. The transistor is available in a 2-lead pill package.

Package Types: 440206
PN: CGHV40180P

Typical Performance Over 800 MHz - 1000 MHz (T_C = 25˚C), 50 V

Parameter	800 MHz	850 MHz	900 MHz	950 MHz	1000 MHz	Units
Small Signal Gain	25.6	25.2	24.6	24.4	24.3	dB
Gain @ Pin 34 dBm	20.4	20.8	20.4	20.1	20.1	dB
Output Power @ Pin 34 dBm	275	302	275	257	257	W
EFF @ Pin 34 dBm	67	75	76	73	71	%

Note:
Measured CW in the CGHV40180P-AMP Application circuit.

RoHS COMPLIANT

FEATURES

- Up to 2000 MHz Operation
- 24 dB Small Signal Gain at 900 MHz
- 20 dB Power Gain at 900 MHz
- 250 W Typical Output Power at 900 MHz
- 75 % Efficiency at P_{SAT}

APPLICATIONS

- Military Communications
- Public Safety VHF-UHF applications
- Radar
- Medical
- Broadband Amplifiers

Large Signal Models Available for ADS and MWO

Rev 1.2 - August 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[1]	T_J	225	˚C	
Maximum Forward Gate Current	I_{GMAX}	42	mA	25˚C
Maximum Drain Current[1]	I_{DMAX}	12.1	A	25˚C
Soldering Temperature[2]	T_S	245	˚C	
CGHV40180P Thermal Resistance, Junction to Case	$R_{θJC}$	0.87	˚C/W	P_{DISS} = 150, 85˚C
Maximum dissipated power		150	W	P_{DISS} = 150, 85˚C
Case Operating Temperature[3]	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] See also, Power Derating Curve on Page 5.

Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics[1] (T_C = 25˚C)						
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 = 1000 mA
Saturated Drain Current[2]	I_{DS}	31.4	37.6	–	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 = 41.8 mA
RF Characteristics[2,3] (T_C = 25˚C, F_0 = 900 MHz unless otherwise noted)						
Small Signal Gain	G_{SS}	22.8	24.0	–	dB	V_{DD} = 50 V, I_{DQ} = 1.0 A, P_{in} = 10dBm CW
Power Gain	G_P	18.4	19.8	–	dB	V_{DD} = 50 V, I_{DQ} = 1.0 A, P_{in} = 34 dBm CW
Power Output at Saturation	P_{OUT}	52.6	53.9	–	dBm	V_{DD} = 50 V, I_{DQ} = 1.0 A, P_{in} = 34 dBm CW
Drain Efficiency[4]	η	59	69	–	%	V_{DD} = 50 V, I_{DQ} = 1.0 A, P_{in} = 34 dBm CW
Output Mismatch Stress	VSWR	–	–	3 : 1	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 1.0 A, P_{OUT} = 180 W CW
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	57.8	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	13.7	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	1.23	–	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] Measurements are to be performed using Cree production test fixture AD-838292P-TB
[4] Drain Efficiency = P_{OUT}/PDC

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CGHV40180P Typical Performance

Figure 1. - Small Signal Gain and Return Loss versus Frequency measured in application circuit CGHV40180P
V_{DD} = 50 V, I_{DQ} = 1.0 A

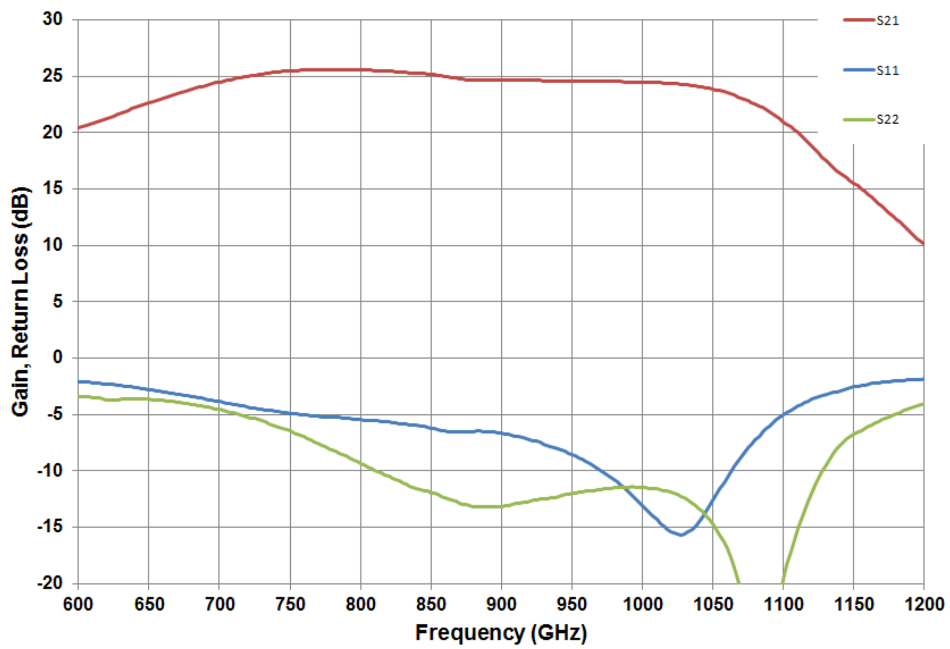
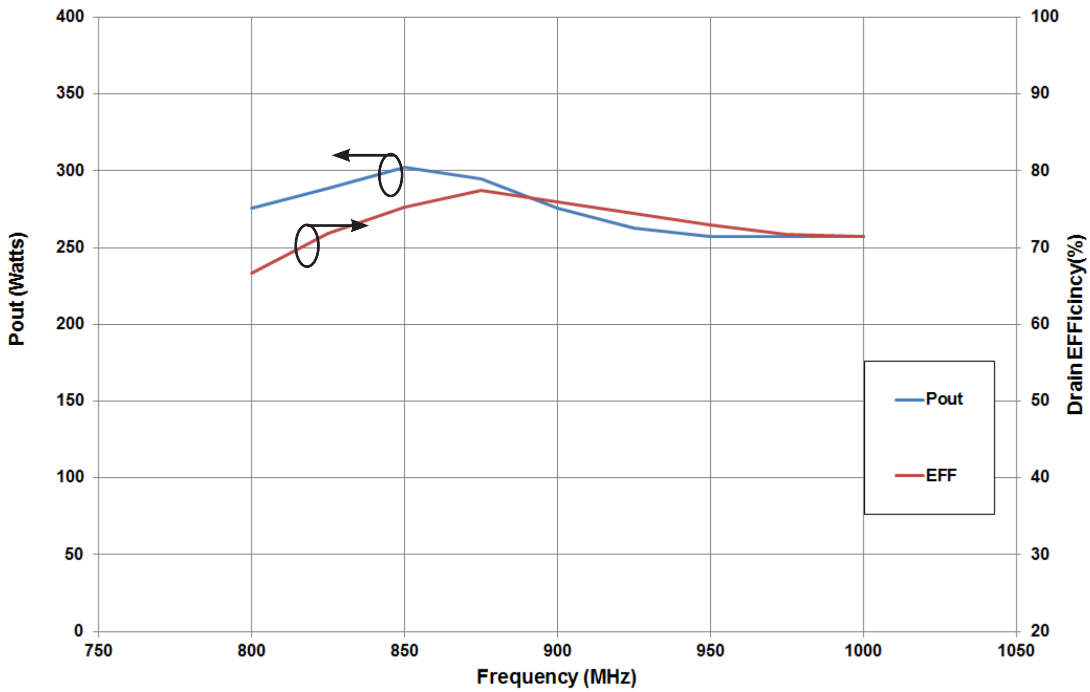


Figure 2. - Output Power and Drain Efficiency vs Frequency CGHV40180P-TB
CW Operation, V_{DD} = 50 V, I_{DQ} = 1.0 A, @ P_{IN} 34 dBm



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CGHV40180P Typical Performance

Figure 3. - Gain and Drain EFF vs. Frequency and Output Power
CGHV40180P-TB
CW Operation, V_{DD} = 50 V, I_{DQ} = 1.0A

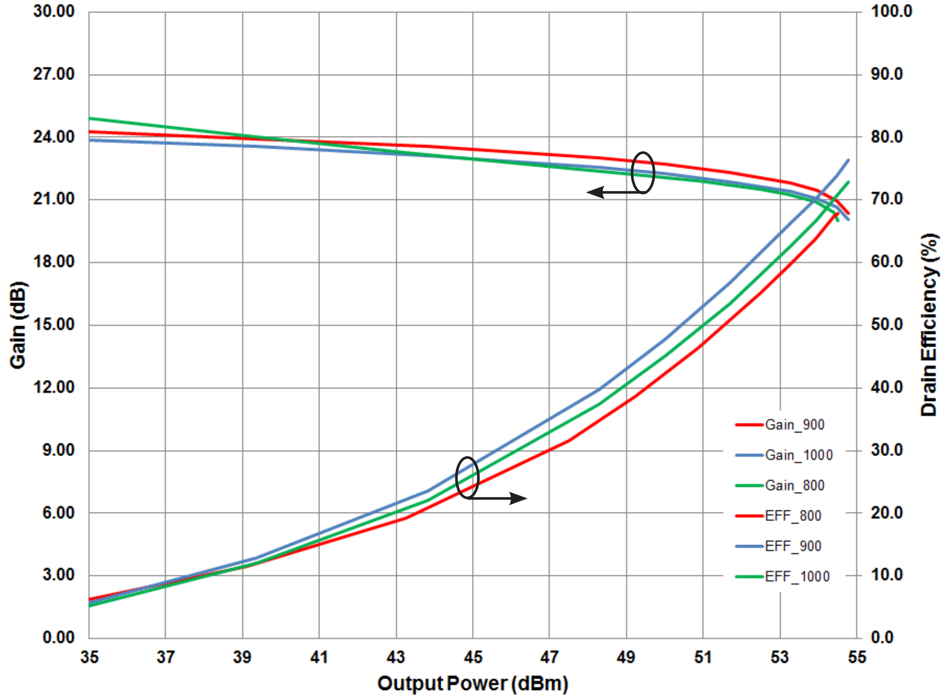
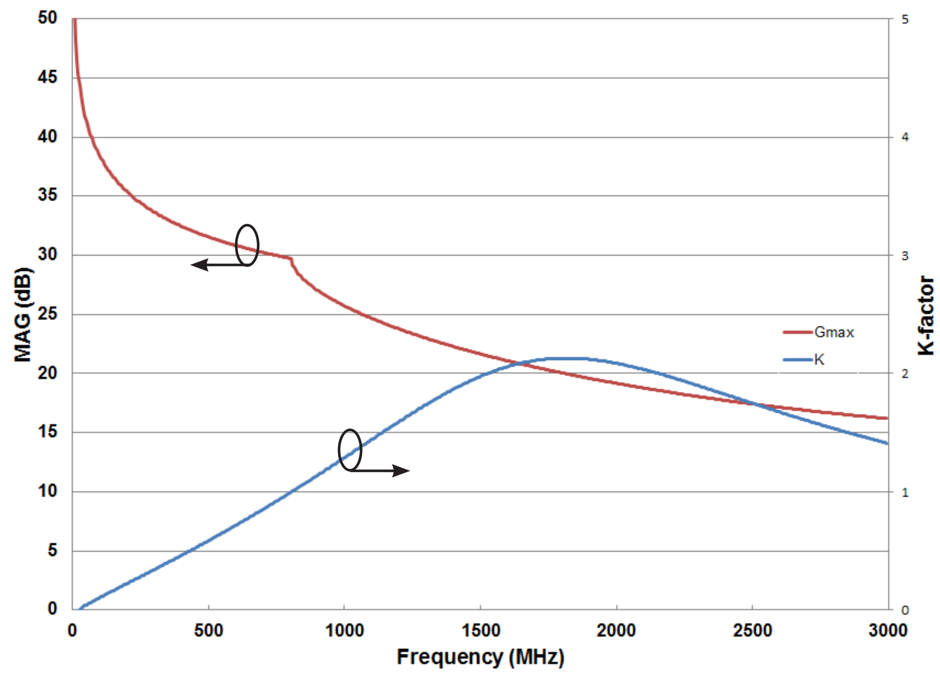


Figure 4. - Simulated Maximum Available Gain and K-factor of the CGHV40180P
V_{DD} = 50 V, I_{DQ} = 1.0 A



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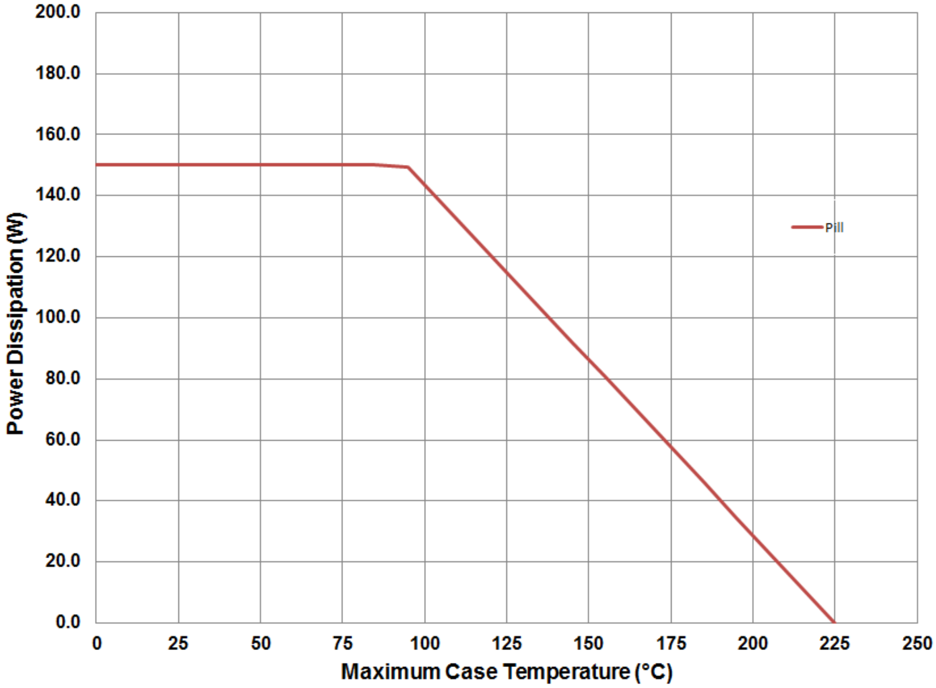
CGHV40180P Power Dissipation De-rating Curve

Figure 5. - Transient Power Dissipation De-rating Curve



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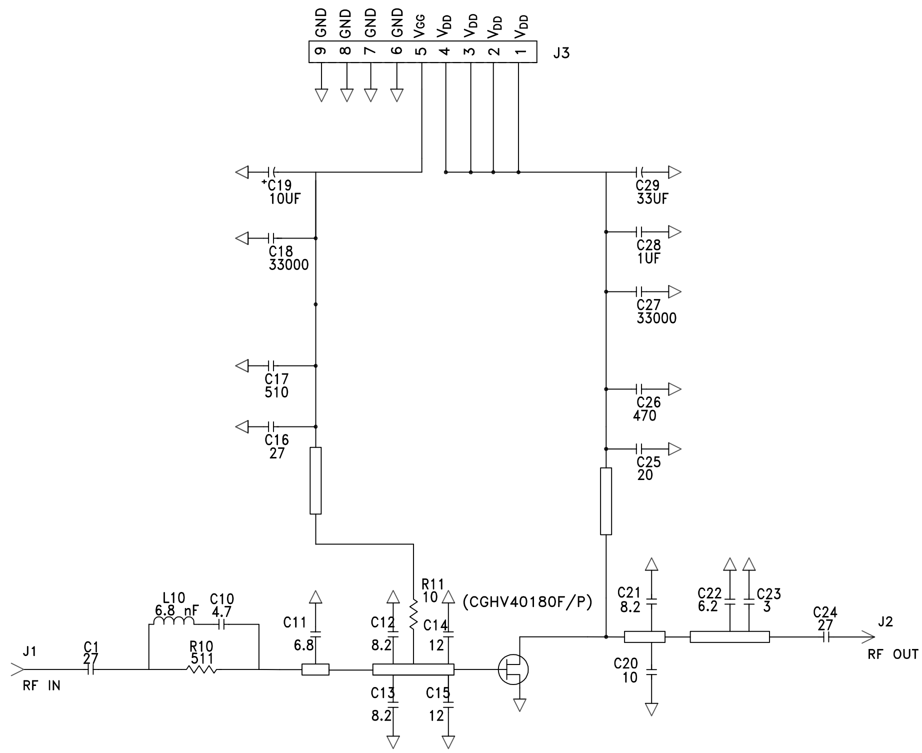
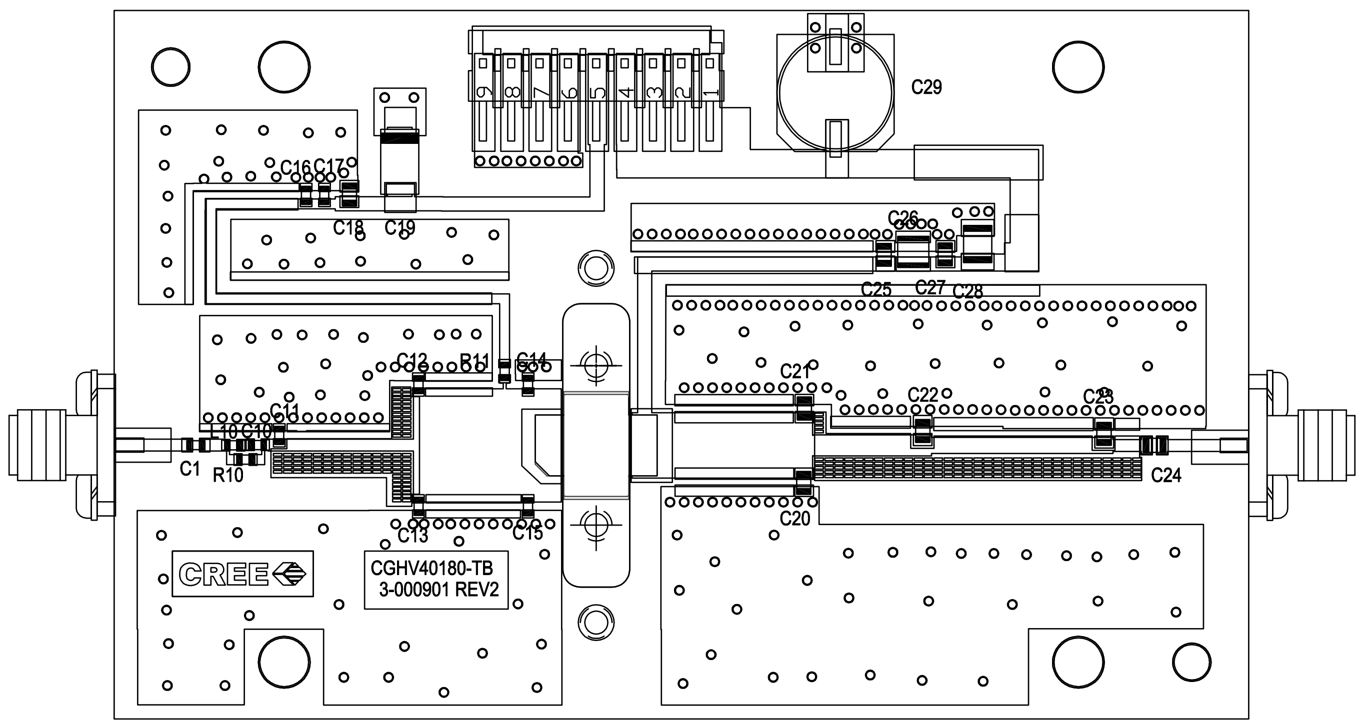
CGHV40180P-AMP Application Circuit Schematic



CGHV40180P-AMP Application Circuit



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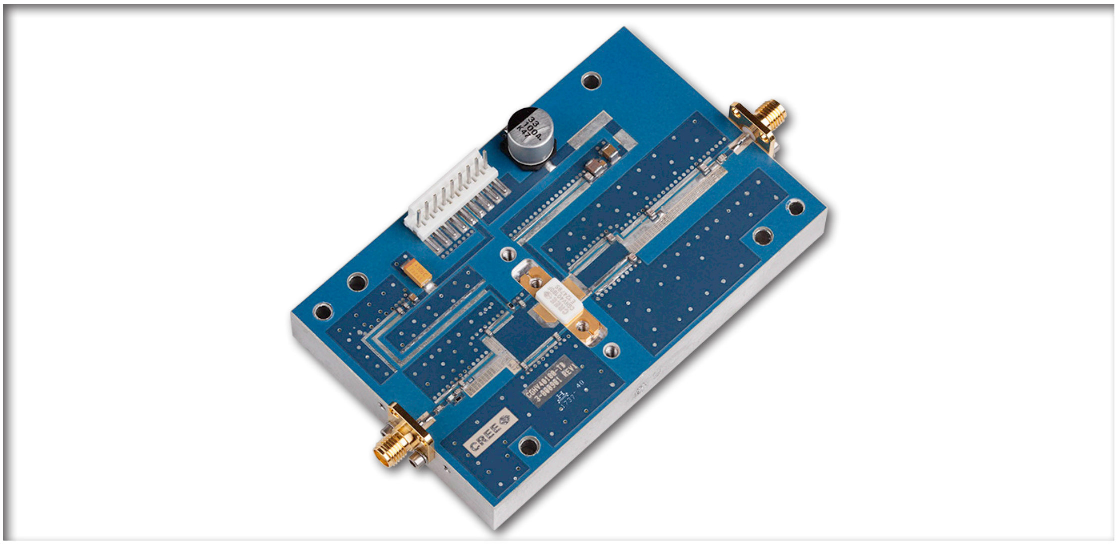
CGHV40180P-AMP Application Circuit Bill of Materials

Designator	Description	Qty
R11	RES, 1/16W, 0603, 1%, 10.0 OHMS	1
R10	RES, 1/16W, 0603, 1%, 511 OHMS	1
C29	CAP, 33UF, 20%, G CASE	1
C28	CAP 1.0UF, 100V, ±10%, X7R, 1210	1
C17	CAP, 510pF, NPO, 5%, 100V, 0603	1
C26	CAP, 470pF, NPO, 5%, 250V, ATC800B	1
C19	CAP, 10UF, 16V TANTALUM, 2312	1
C14, C15	CAP, 12.0pF, ±5%, 0603, ATC600S	2
C1, C16	CAP, 27pF, ±5%, 0603, ATC600S	2
C10	CAP, 4.7pF, ±0.1pF, 0603, ATC600S	1
C11	CAP, 6.8pF, ±0.25pF, 0603, ATC600S	1
C12, C13	CAP, 8.2pF, ±0.25 pF, 0603, ATC600S	2
C18, C27	CAP, 33000pF, 0805, 100V, X7R	2
C20	CAP, 10pF, ±1%, 250V, 0805, ATC600F	2
C25	CAP, 20pF, ±5%, 250V, 0805, ATC600F	1
C24	CAP, 27pF, ±5%, 250V, 0805, ATC600F	1
C23	CAP, 3.0pF, ±0.1pF, 250V, 0805, ATC600F	2
C22	CAP, 6.2pF, ±0.1pF, 250V, 0805, ATC600F	1
C21	CAP, 8.2pF, ±0.1pF, 250V, 0805 ATC600F	1
-	PCB ROGERS HTC6035, 0.020 THK, ER 3.60	1
J1,J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4 HOLE BLUNT POST	2
J3	HEADER RT>PLZ .1CEN LK 9POS	1
L10	INDUCTOR, CHIP, 6.8nH, 5%, 0603 SMT, DIGIKEY 712-1432-1-ND	1
Q1	CGHV40180	1

CGHV40180-AMP Demonstration Amplifier Circuit



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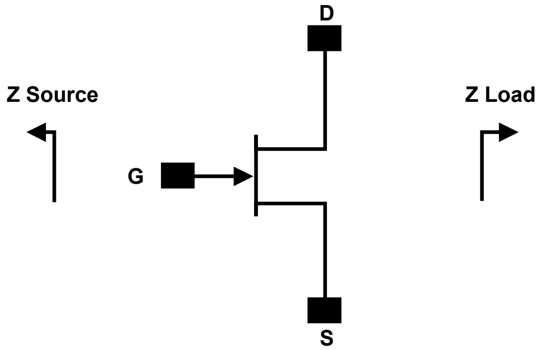
Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
50	23.7 + J25.9	7.6 + J0.6
150	7.4 + J8.3	8.1 + J0.7
250	4.2 +J7.9	7.9 + J2.2
500	1.4 + J1.5	4.7 + J2.7
750	1.0 + J0.0	3.9 + J2.3
1000	0.7 + J1.1	4.0 + J1.8

Note 1. V_{DD} = 50 V, I_{DQ} = 1.0A in the 440206 package.

Note 2. Optimized for Power Gain, P_{SAT} and Drain Efficiency

Note 3. When using this device at low frequency, series resistor should be used to maintain amplifier stability

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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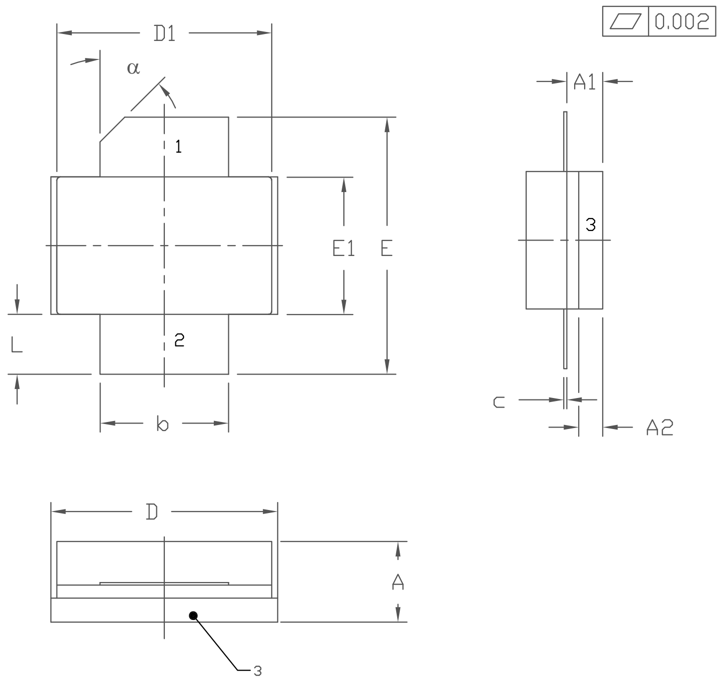
Product Dimensions CGHV40180P (Package Type — 440206)



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M - 1994.
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 PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

	INCHES		MILLIMETERS		NOTES
DIM	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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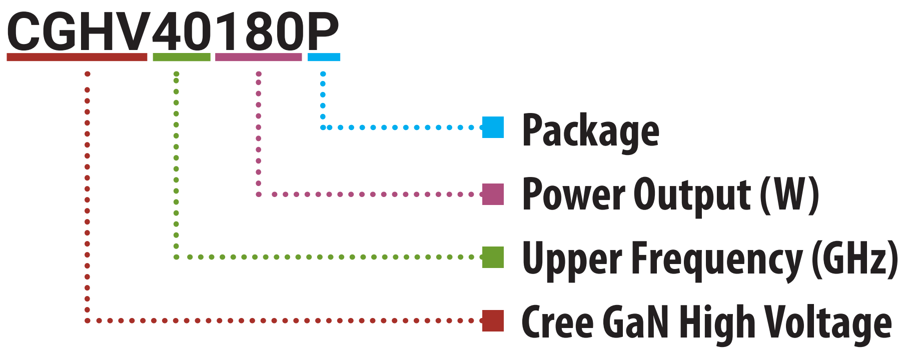
Part Number System



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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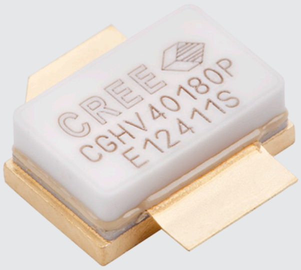
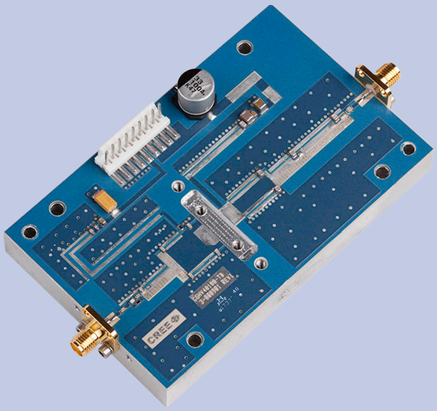
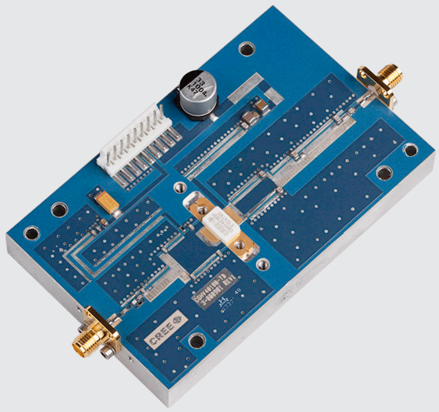
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV40180P	GaN HEMT	Each	
CGHV40180P-TB	Test board without GaN HEMT	Each	
CGHV40180P-AMP	Test board with GaN HEMT(pill) installed	Each	

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