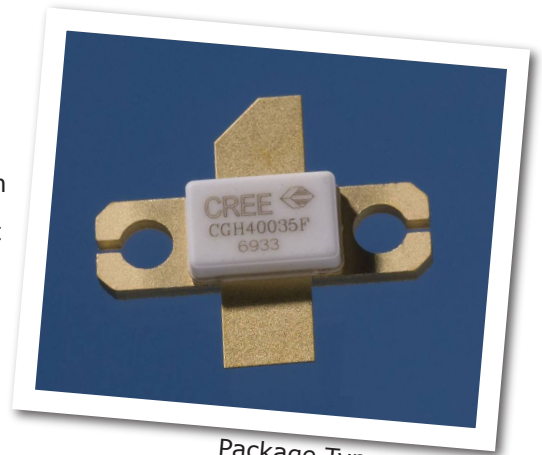


CGH40035

35 W, RF Power GaN HEMT

Cree's CGH40035 is an unmatched, gallium nitride (GaN) high electron mobility transistor (HEMT). The CGH40035, 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 CGH40035 ideal for linear and compressed amplifier circuits. The transistor is available in a screw-down, flange package.



Package Type: 440193
PN: CGH40035F

FEATURES

- Up to 4 GHz Operation
- 15 dB Small Signal Gain at 2.0 GHz
- 13 dB Small Signal Gain at 4.0 GHz
- 45 W typical P_{3dB}
- 60 % Efficiency at P_{3dB}
- 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



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

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DS}	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}	10.0	mA
Soldering Temperature	T_S	225	°C
Screw Torque	T	80	in-oz
Thermal Resistance, Junction to Case ¹	R_{JC}	3.0	°C/W

Note:

¹ Measured for the CGH40035F at $P_{DISS} = 32$ W.

Electrical Characteristics ($T_c = 25^\circ\text{C}$)

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics²						
Gate Threshold Voltage	$V_{GS(th)}$	-3.0	-2.5	-1.8	VDC	$V_{DS} = 10$ V, $I_D = 10.8$ mA
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.0	-	VDC	$V_{DS} = 28$ V, $I_D = 500$ mA
Saturated Drain Current	I_{DS}	7.2	8.1	-	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	V_{BR}	84	100	-	VDC	$V_{GS} = -8$ V, $I_D = 10.8$ mA
Case Operating Temperature	T_c	-10	-	+80	°C	at 32 W P_{DISS}
RF Characteristics² ($T_c = 25^\circ\text{C}$, $F_0 = 3.5$ GHz unless otherwise noted)						
Small Signal Gain	G_{SS}	13	14	-	dB	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA
Power Output at 3 dB Compression	P_{3dB}	35	45	-	W	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA
Drain Efficiency ¹	η	50	60	-	%	$V_{DD} = 28$ V, $I_{DQ} = 500$ mA, P_{3dB}
Output Mismatch Stress	VSWR	-	TBD	-	Ψ	No damage at all phase angles, $V_{DD} = 28$ V, $I_{DQ} = 500$ mA, $P_{OUT} = 35$ W CW
Dynamic Characteristics						
Input Capacitance	C_{GS}	-	12.8	-	pF	$V_{DS} = 28$ V, $V_{gs} = -8$ V, $f = 1$ MHz
Output Capacitance	C_{DS}	-	3.9	-	pF	$V_{DS} = 28$ V, $V_{gs} = -8$ V, $f = 1$ MHz
Feedback Capacitance	C_{GD}	-	1.1	-	pF	$V_{DS} = 28$ V, $V_{gs} = -8$ V, $f = 1$ MHz

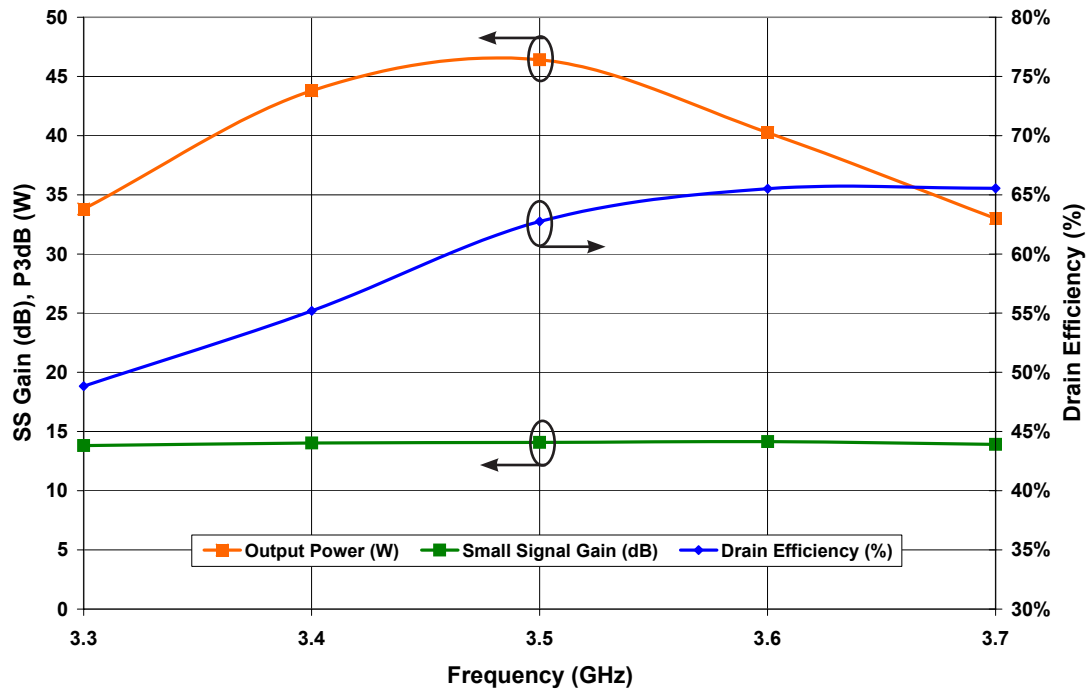
Notes:

¹ Drain Efficiency = P_{OUT} / P_{DC}

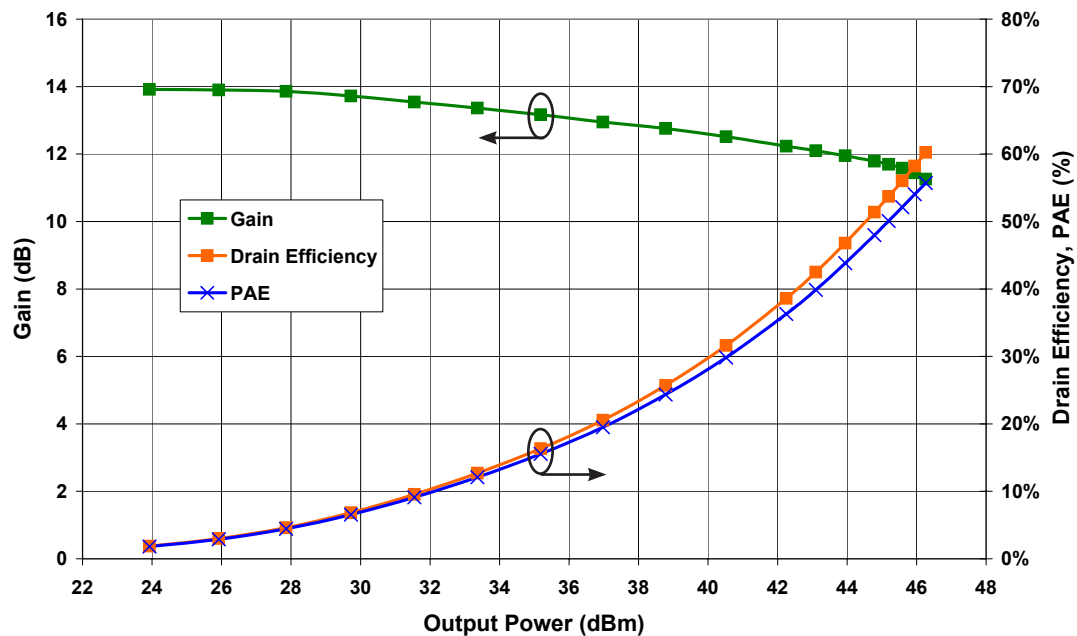
² Measured in CGH40035F-TB.

Typical Performance

**P3dB, Gain, and Drain Efficiency vs Frequency of the
CGH40035F in the CGH40035F-TB**
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 250\text{ mA}$



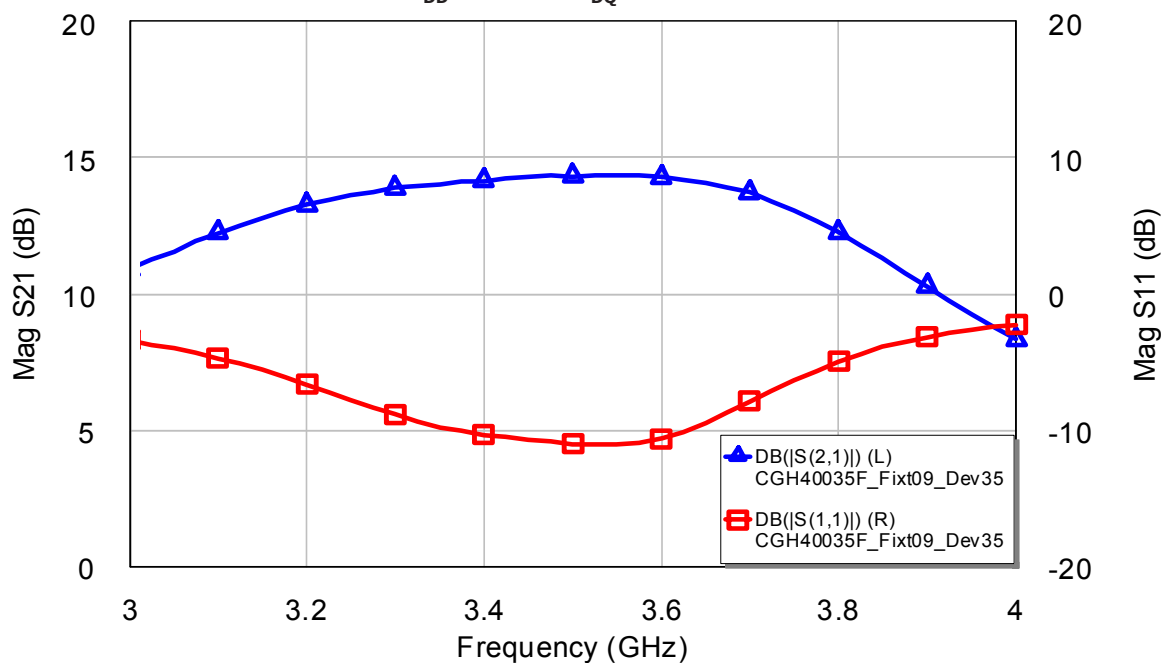
**Swept CW Data of CGH40035 vs. Output Power with Source
and Load Impedances Optimized for P3dB Power in CGH40035-TB**
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 250\text{ mA}$, Freq = 3.5 GHz



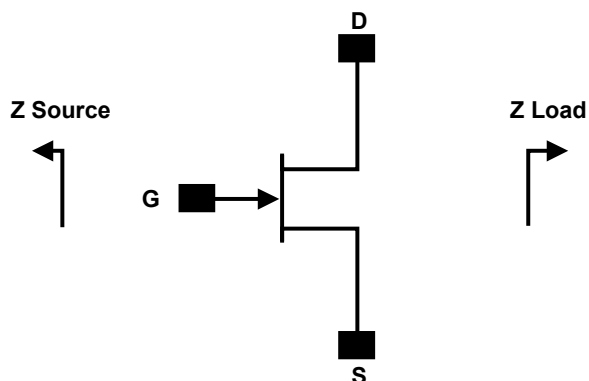
Typical Performance

Simulated Small Signal Gain and Input Return Loss of the CGH40035-TB vs Frequency

$V_{DD} = 28\text{ V}$, $I_{DQ} = 250\text{ mA}$



Source and Load Impedances



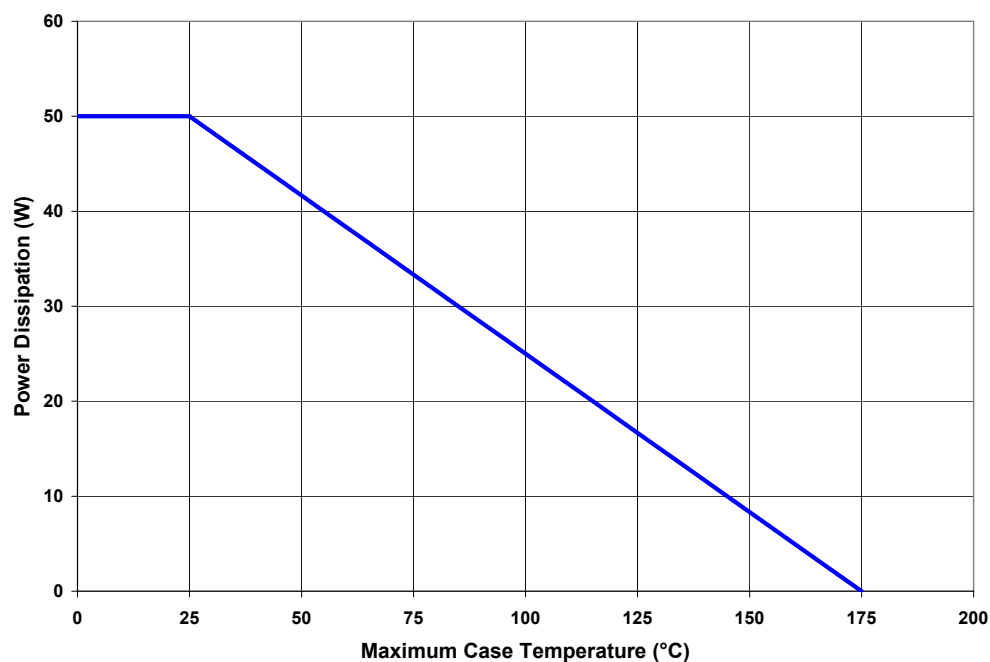
Frequency (MHz)	Z Source	Z Load
500	$3.01 + j9.10$	$3.06 + j9.10$
1000	$2.65 + j0.23$	$2.67 + j8.54$
1500	$2.60 - j1.38$	$3.70 + j4.35$
2500	$2.14 - j5.50$	$4.01 - j1.46$
3500	$2.70 - j9.90$	$5.40 - j3.00$

Note 1. $V_{DD} = 28V$, $I_{DQ} = 500mA$, $T_{CASE} = 25^{\circ}C$ in the 440193 package.

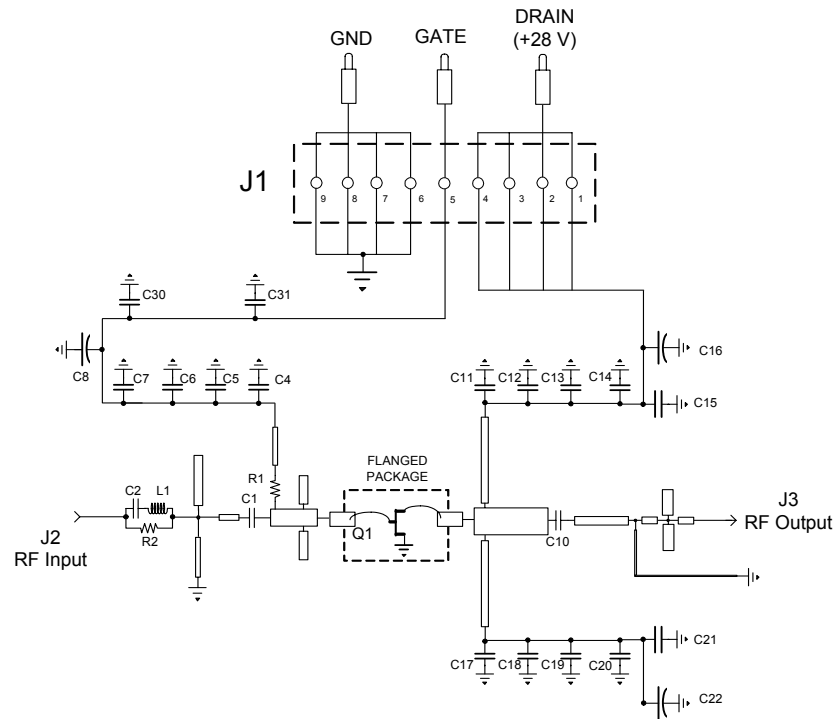
Note 2. Optimized for P_{3dB}

Note 3. When using this device below 2GHz, series resistors should be used to maintain amplifier stability.

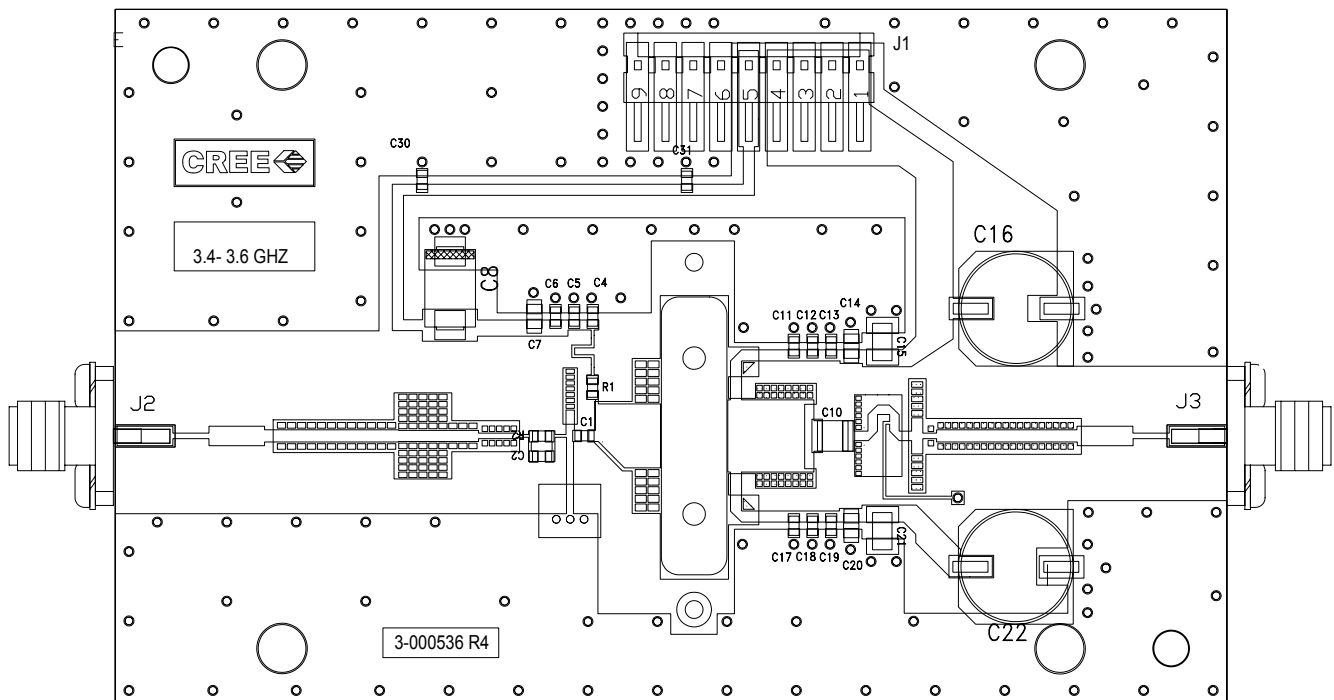
CGH40035 Power Dissipation De-rating Curve



CGH40035F-TB Demonstration Amplifier Circuit Schematic



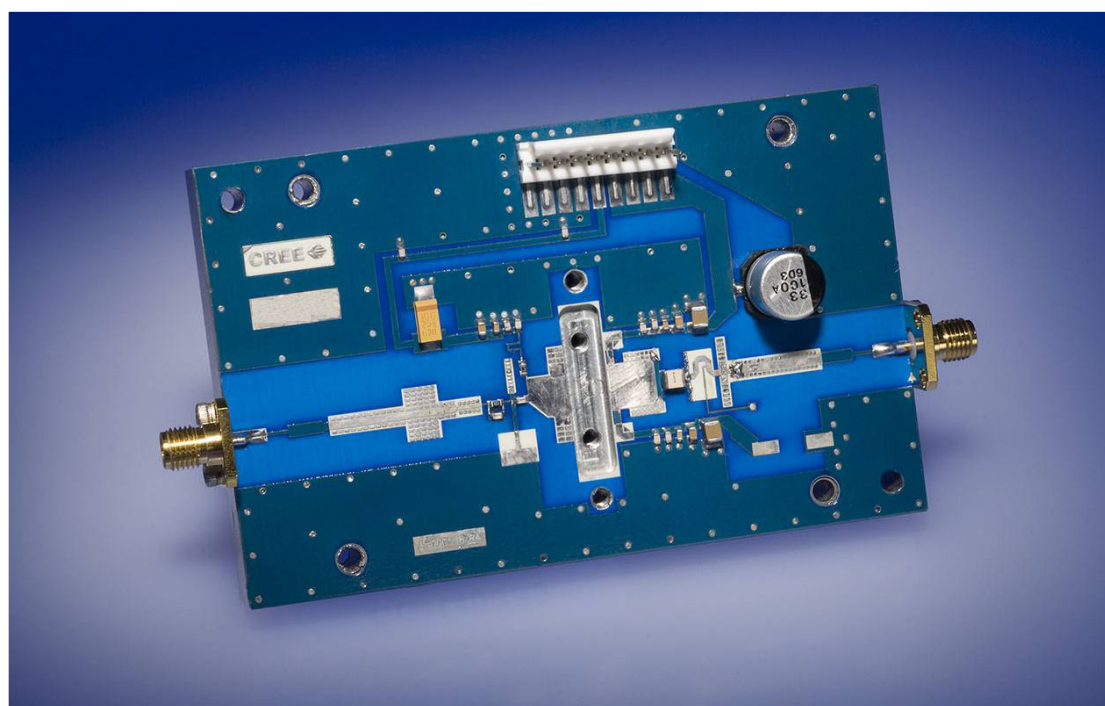
CGH40035F-TB Demonstration Amplifier Circuit Outline



CGH40035F-TB Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R1	RES, 1/16W, 0603, $\leq 5\%$, 5.1 OHMS	1
R2	RES, 1/16W, 0603, 1%, 100 OHMS	1
C6,C13,C19	CAP, 470PF, 5%, 100V, 0603	3
C16,C22	CAP, 33 UF, 20%, G CASE	2
C15,C21	CAP, 1.0UF, 100V, 10%, X7R, 1210	2
C8	CAP 10UF 16V TANTALUM	1
C1	CAP, 0.6pF, +/-0.05pF, 0603	1
C2	CAP, 1.2pF, +/-0.1pF, 0603	1
C10	CAP 4.7PF, +/- 0.25pF	1
C4,C11,C17	CAP, 7.5pF, +/-0.1pF, 0603	3
C5,C12,C18,C30,C31	CAP, 47pF, +/-5%pF, 0603	5
C7,C14,C20	CAP,33000PF, 0805,100V, X7R	3
J2,J3	CONN SMA STR PANEL JACK RECP	2
J1	HEADER RT>PLZ .1CEN LK 9POS	1
Q1	CGH40035F	1

CGH40035F-TB Demonstration Amplifier Circuit





Typical Package S-Parameters for CGH40035 (Small Signal, $V_{DS} = 28\text{ V}$, $I_{DQ} = 250\text{ mA}$, angle in degrees)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.9251	-171.95	7.64	83.34	0.01702	-0.91	0.6779	-173.61
600 MHz	0.9249	-174.21	6.38	80.17	0.01703	-2.92	0.6800	-174.51
700 MHz	0.9248	-175.97	5.48	77.24	0.01702	-4.67	0.6820	-175.15
800 MHz	0.9247	-177.43	4.81	74.48	0.01701	-6.26	0.6840	-175.64
900 MHz	0.9247	-178.70	4.28	71.82	0.01700	-7.72	0.6861	-176.02
1.0 GHz	0.9246	-179.82	3.86	69.25	0.01699	-9.10	0.6883	-176.35
1.1 GHz	0.9245	-179.15	3.52	66.74	0.01698	-10.40	0.6905	-176.64
1.2 GHz	0.9245	-178.19	3.24	64.28	0.01696	-11.63	0.6928	-176.90
1.3 GHz	0.9243	-177.28	3.00	61.86	0.01695	-12.82	0.6952	-177.15
1.4 GHz	0.9242	-176.41	2.80	59.47	0.01694	-13.94	0.6976	-177.40
1.5 GHz	0.9240	-175.56	2.62	57.11	0.01694	-15.03	0.7000	-177.65
1.6 GHz	0.9238	-174.73	2.47	54.79	0.01694	-16.06	0.7024	-177.91
1.7 GHz	0.9235	-173.90	2.34	52.48	0.01694	-17.06	0.7047	-178.17
1.8 GHz	0.9232	-173.08	2.22	50.20	0.01695	-18.00	0.7070	-178.45
1.9 GHz	0.9228	-172.26	2.12	47.93	0.01697	-18.91	0.7093	-178.74
2.0 GHz	0.9223	-171.43	2.03	45.68	0.01700	-19.78	0.7114	-179.05
2.1 GHz	0.9218	-170.60	1.95	43.44	0.01703	-20.61	0.7134	-179.37
2.2 GHz	0.9211	-169.75	1.88	41.22	0.01708	-21.40	0.7153	-179.71
2.3 GHz	0.9204	-168.88	1.81	39.00	0.01714	-22.16	0.7170	-179.93
2.4 GHz	0.9196	-168.00	1.76	36.79	0.01721	-22.87	0.7186	-179.56
2.5 GHz	0.9186	-167.09	1.71	34.58	0.01730	-23.55	0.7200	-179.17
2.6 GHz	0.9175	-166.16	1.66	32.38	0.01740	-24.20	0.7212	-178.76
2.7 GHz	0.9163	-165.20	1.62	30.17	0.01753	-24.82	0.7222	-178.33
2.8 GHz	0.9149	-164.20	1.59	27.95	0.01767	-25.40	0.7230	-177.89
2.9 GHz	0.9134	-163.17	1.56	25.73	0.01784	-25.96	0.7235	-177.42
3.0 GHz	0.9117	-162.10	1.53	23.50	0.01803	-26.48	0.7238	-176.94
3.1 GHz	0.9098	-160.98	1.51	21.25	0.01824	-26.99	0.7238	-176.44
3.2 GHz	0.9077	-159.82	1.49	18.98	0.01849	-27.48	0.7236	-175.92
3.3 GHz	0.9053	-158.60	1.48	16.68	0.01877	-27.95	0.7230	-175.38
3.4 GHz	0.9027	-157.32	1.47	14.36	0.01909	-28.41	0.7221	-174.82
3.5 GHz	0.8998	-155.97	1.46	12.00	0.01945	-28.87	0.7209	-174.24
3.6 GHz	0.8966	-154.56	1.46	9.60	0.01985	-29.32	0.7194	-173.64
3.7 GHz	0.8930	-153.06	1.45	7.15	0.02030	-29.79	0.7175	-173.01
3.8 GHz	0.8891	-151.47	1.46	4.65	0.02081	-30.27	0.7152	-172.37
3.9 GHz	0.8847	-149.78	1.46	2.09	0.02137	-30.77	0.7125	-171.70
4.0 GHz	0.8798	-147.98	1.47	-0.54	0.02200	-31.30	0.7094	-171.00
4.1 GHz	0.8744	-146.06	1.48	-3.25	0.02271	-31.88	0.7059	-170.29
4.2 GHz	0.8685	-144.00	1.50	-6.04	0.02350	-32.51	0.7019	-169.54
4.3 GHz	0.8618	-141.79	1.52	-8.93	0.02438	-33.21	0.6974	-168.77
4.4 GHz	0.8544	-139.41	1.54	-11.93	0.02537	-34.00	0.6924	-167.97
4.5 GHz	0.8462	-136.84	1.57	-15.06	0.02646	-34.89	0.6869	-167.13



Typical Package S-Parameters for CGH40035 (Small Signal, $V_{DS} = 28\text{ V}$, $I_{DQ} = 500\text{ mA}$, angle in degrees)

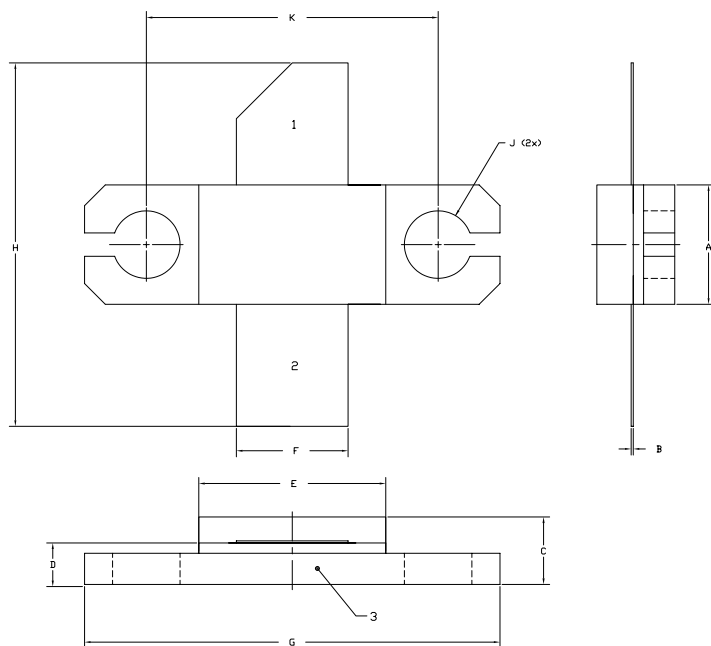
Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.9383	-173.30	7.61	83.76	0.0134	1.07	0.70951	-176.13
600 MHz	0.9381	-175.41	6.36	80.86	0.0134	-0.36	0.71064	-176.94
700 MHz	0.9378	-177.08	5.47	78.17	0.0135	-1.57	0.71156	-177.56
800 MHz	0.9376	-178.48	4.80	75.62	0.0135	-2.62	0.71239	-178.06
900 MHz	0.9373	-179.70	4.29	73.16	0.0135	-3.58	0.71319	-178.48
1.0 GHz	0.9370	179.20	3.87	70.77	0.0135	-4.45	0.71397	-178.85
1.1 GHz	0.9367	178.19	3.54	68.43	0.0136	-5.26	0.71474	-179.19
1.2 GHz	0.9363	177.24	3.26	66.13	0.0136	-6.03	0.71550	-179.51
1.3 GHz	0.9359	176.33	3.03	63.85	0.0137	-6.74	0.71625	-179.82
1.4 GHz	0.9355	175.45	2.83	61.60	0.0137	-7.41	0.71698	179.89
1.5 GHz	0.9350	174.60	2.66	59.38	0.0138	-8.05	0.71767	179.59
1.6 GHz	0.9344	173.75	2.51	57.16	0.0138	-8.65	0.71833	179.29
1.7 GHz	0.9338	172.92	2.38	54.96	0.0139	-9.22	0.71892	178.99
1.8 GHz	0.9331	172.09	2.27	52.77	0.0140	-9.76	0.71945	178.68
1.9 GHz	0.9324	171.25	2.17	50.59	0.0141	-10.27	0.71990	178.36
2.0 GHz	0.9315	170.41	2.08	48.42	0.0142	-10.75	0.72025	178.04
2.1 GHz	0.9306	169.55	2.00	46.24	0.0143	-11.20	0.72050	177.70
2.2 GHz	0.9296	168.69	1.94	44.07	0.0145	-11.63	0.72062	177.36
2.3 GHz	0.9285	167.80	1.87	41.90	0.0146	-12.03	0.72061	177.00
2.4 GHz	0.9272	166.90	1.82	39.73	0.0148	-12.42	0.72046	176.63
2.5 GHz	0.9259	165.97	1.77	37.54	0.0150	-12.78	0.72013	176.24
2.6 GHz	0.9244	165.01	1.73	35.35	0.0152	-13.13	0.71964	175.84
2.7 GHz	0.9228	164.03	1.70	33.15	0.0154	-13.46	0.71894	175.43
2.8 GHz	0.9210	163.01	1.66	30.94	0.0157	-13.79	0.71805	175.00
2.9 GHz	0.9190	161.95	1.64	28.70	0.0160	-14.10	0.71693	174.56
3.0 GHz	0.9169	160.85	1.61	26.45	0.0163	-14.42	0.71557	174.10
3.1 GHz	0.9145	159.70	1.59	24.17	0.0167	-14.73	0.71395	173.62
3.2 GHz	0.9119	158.50	1.58	21.86	0.0171	-15.06	0.71207	173.13
3.3 GHz	0.9091	157.25	1.57	19.52	0.0175	-15.39	0.70990	172.62
3.4 GHz	0.9060	155.93	1.56	17.14	0.0180	-15.75	0.70742	172.10
3.5 GHz	0.9025	154.55	1.56	14.72	0.0185	-16.13	0.70462	171.55
3.6 GHz	0.8988	153.09	1.55	12.25	0.0191	-16.55	0.70148	170.99
3.7 GHz	0.8946	151.54	1.56	9.72	0.0197	-17.01	0.69797	170.41
3.8 GHz	0.8901	149.90	1.56	7.13	0.0204	-17.53	0.69408	169.81
3.9 GHz	0.8850	148.16	1.57	4.47	0.0212	-18.10	0.68979	169.20
4.0 GHz	0.8795	146.30	1.58	1.74	0.0221	-18.75	0.68507	168.56
4.1 GHz	0.8734	144.32	1.60	-1.08	0.0230	-19.49	0.67991	167.90
4.2 GHz	0.8666	142.19	1.62	-4.00	0.0241	-20.32	0.67429	167.23
4.3 GHz	0.8591	139.91	1.64	-7.02	0.0252	-21.27	0.66818	166.53
4.4 GHz	0.8508	137.45	1.67	-10.17	0.0265	-22.34	0.66156	165.81
4.5 GHz	0.8416	134.78	1.70	-13.44	0.0279	-23.56	0.65443	165.07



Typical Package S-Parameters for CGH40035 (Small Signal, $V_{DS} = 28\text{ V}$, $I_{DQ} = 750\text{ mA}$, angle in degrees)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.9433	-173.80	7.49	83.77	0.0122	1.78	0.71712	-176.84
600 MHz	0.9431	-175.85	6.26	80.94	0.0123	0.56	0.71802	-177.60
700 MHz	0.9428	-177.48	5.38	78.31	0.0123	-0.44	0.71872	-178.19
800 MHz	0.9425	-178.85	4.73	75.82	0.0123	-1.30	0.71932	-178.68
900 MHz	0.9422	179.94	4.22	73.41	0.0124	-2.06	0.71987	-179.10
1.0 GHz	0.9419	178.86	3.82	71.07	0.0124	-2.75	0.72038	-179.47
1.1 GHz	0.9416	177.86	3.49	68.77	0.0124	-3.37	0.72087	-179.82
1.2 GHz	0.9411	176.91	3.21	66.50	0.0125	-3.95	0.72133	179.86
1.3 GHz	0.9407	176.00	2.98	64.27	0.0126	-4.49	0.72176	179.54
1.4 GHz	0.9402	175.13	2.79	62.06	0.0126	-4.99	0.72216	179.23
1.5 GHz	0.9396	174.27	2.62	59.86	0.0127	-5.45	0.72251	178.92
1.6 GHz	0.9390	173.43	2.48	57.68	0.0128	-5.89	0.72281	178.61
1.7 GHz	0.9384	172.59	2.35	55.51	0.0129	-6.29	0.72304	178.30
1.8 GHz	0.9376	171.75	2.24	53.34	0.0130	-6.67	0.72320	177.98
1.9 GHz	0.9368	170.91	2.15	51.18	0.0131	-7.02	0.72327	177.65
2.0 GHz	0.9359	170.06	2.06	49.03	0.0132	-7.35	0.72324	177.32
2.1 GHz	0.9349	169.20	1.99	46.87	0.0134	-7.65	0.72310	176.98
2.2 GHz	0.9338	168.32	1.92	44.72	0.0135	-7.94	0.72283	176.62
2.3 GHz	0.9326	167.43	1.86	42.56	0.0137	-8.20	0.72242	176.26
2.4 GHz	0.9313	166.52	1.81	40.39	0.0139	-8.46	0.72186	175.88
2.5 GHz	0.9299	165.58	1.76	38.22	0.0141	-8.70	0.72113	175.49
2.6 GHz	0.9284	164.61	1.72	36.03	0.0144	-8.93	0.72022	175.09
2.7 GHz	0.9267	163.61	1.69	33.84	0.0147	-9.15	0.71912	174.67
2.8 GHz	0.9248	162.58	1.66	31.62	0.0150	-9.37	0.71781	174.24
2.9 GHz	0.9228	161.51	1.63	29.39	0.0153	-9.60	0.71627	173.79
3.0 GHz	0.9205	160.39	1.61	27.13	0.0156	-9.83	0.71449	173.33
3.1 GHz	0.9181	159.23	1.59	24.85	0.0160	-10.08	0.71245	172.86
3.2 GHz	0.9155	158.02	1.58	22.53	0.0165	-10.34	0.71014	172.36
3.3 GHz	0.9125	156.75	1.57	20.18	0.0170	-10.63	0.70753	171.86
3.4 GHz	0.9093	155.41	1.56	17.79	0.0175	-10.95	0.70462	171.33
3.5 GHz	0.9058	154.00	1.56	15.35	0.0181	-11.31	0.70137	170.79
3.6 GHz	0.9019	152.52	1.56	12.86	0.0187	-11.72	0.69777	170.23
3.7 GHz	0.8977	150.95	1.56	10.32	0.0194	-12.19	0.69380	169.65
3.8 GHz	0.8930	149.28	1.57	7.77	0.0202	-12.72	0.68944	169.06
3.9 GHz	0.8879	147.51	1.58	5.02	0.0211	-13.32	0.68467	168.45
4.0 GHz	0.8822	145.63	1.59	2.26	0.0220	-14.02	0.67946	167.82
4.1 GHz	0.8759	143.61	1.61	-0.59	0.0230	-14.82	0.67380	167.17
4.2 GHz	0.8690	141.44	1.63	-3.54	0.0242	-15.72	0.66767	166.51
4.3 GHz	0.8613	139.12	1.65	-6.61	0.0254	-16.76	0.66104	165.83
4.4 GHz	0.8528	136.61	1.68	-9.79	0.0268	-17.93	0.65391	165.13
4.5 GHz	0.8434	133.90	1.71	-13.11	0.0283	-19.26	0.64625	164.41

Product Dimensions CGH40035F (Package Type — 440193)



NOTES:

1. DIMENSIONING AND TOLERANCING 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.

DIM	INCHES		MILLIMETERS	
	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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