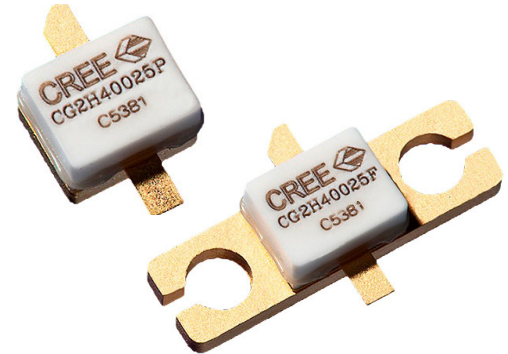


CG2H40025

25 W, 28 V RF Power GaN HEMT

Description

Cree's CG2H40025 is an unmatched, gallium nitride (GaN) high electron mobility transistor (HEMT). The CG2H40025, 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 CG2H40025 ideal for linear and compressed amplifier circuits. The transistor is available in a screw-down, flange package and solder-down, pill packages.



Package Types: 440196 and 440166
PNs: CG2H40025P and CG2H40025F

Features

- Up to 6 GHz Operation
- 17 dB Small Signal Gain at 2.0 GHz
- 15 dB Small Signal Gain at 4.0 GHz
- 30 W typical P_{SAT}
- 70% Efficiency at P_{SAT}
- 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	Conditions
Drain-Source Voltage	V_{DS}	120	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}	7.0	mA	25 °C
Maximum Drain Current ¹	I_{DMAX}	3	A	25 °C
Soldering Temperature ²	T_S	245	°C	
Screw Torque	τ	40	in-oz	
Thermal Resistance, Junction to Case ³	$R_{\theta JC}$	4.8	°C/W	85 °C
Case Operating Temperature ^{3,4}	T_C	-40, +150	°C	

Notes:

¹ Current limit for long term, reliable operation² Refer to the Application Note on soldering at wolfspeed.com/RF/Document-Library³ Measured for the CG2H40025F at $P_{DISS} = 28.8$ W⁴ See also, the Power Dissipation De-rating Curve on Page 6**Electrical Characteristics ($T_C = 25^\circ\text{C}$)**

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics¹						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	V_{DC}	$V_{DS} = 10$ V, $I_D = 7.2$ mA
Gate Quiescent Voltage	$V_{GS(Q)}$	–	-2.7	–	V_{DC}	$V_{DS} = 28$ V, $I_D = 250$ mA
Saturated Drain Current	I_{DS}	5.2	7.2	–	A	$V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V
Drain-Source Breakdown Voltage	V_{BR}	84	–	–	V_{DC}	$V_{GS} = -8$ V, $I_D = 7.2$ mA
RF Characteristics² ($T_C = 25^\circ\text{C}$, $F_0 = 3.7$ GHz unless otherwise noted)						
Small Signal Gain	G_{SS}	13.0	14.8	–	dB	$V_{DD} = 28$ V, $I_{DQ} = 250$ mA
Output Power ³	P_{SAT}	25	34	–		$V_{DD} = 28$ V, $I_{DQ} = 250$ mA
Drain Efficiency ⁴	η	57	71	–	%	$V_{DD} = 28$ V, $I_{DQ} = 250$ mA, P_{SAT}
Output Mismatch Stress	VSWR	–	–	10 : 1	Y	No damage at all phase angles, $V_{DD} = 28$ V, $I_{DQ} = 250$ mA, $P_{OUT} = 25$ W CW
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	7.5	–	pF	$V_{DS} = 28$ V, $V_{GS} = -8$ V, $f = 1$ MHz
Output Capacitance	C_{DS}	–	2.4	–	pF	$V_{DS} = 28$ V, $V_{GS} = -8$ V, $f = 1$ MHz
Feedback Capacitance	C_{GD}	–	0.4	–	pF	$V_{DS} = 28$ V, $V_{GS} = -8$ V, $f = 1$ MHz

Notes:

¹ Measured on wafer prior to packaging² Measured in CG2H40025-AMP³ P_{SAT} is defined as $I_G = 0.72$ mA⁴ Drain Efficiency = P_{OUT} / P_{DC}

Typical Performance

Figure 1. Small Signal Gain and Return Loss vs Frequency of the CG2H40025F in the CG2H40025-AMP

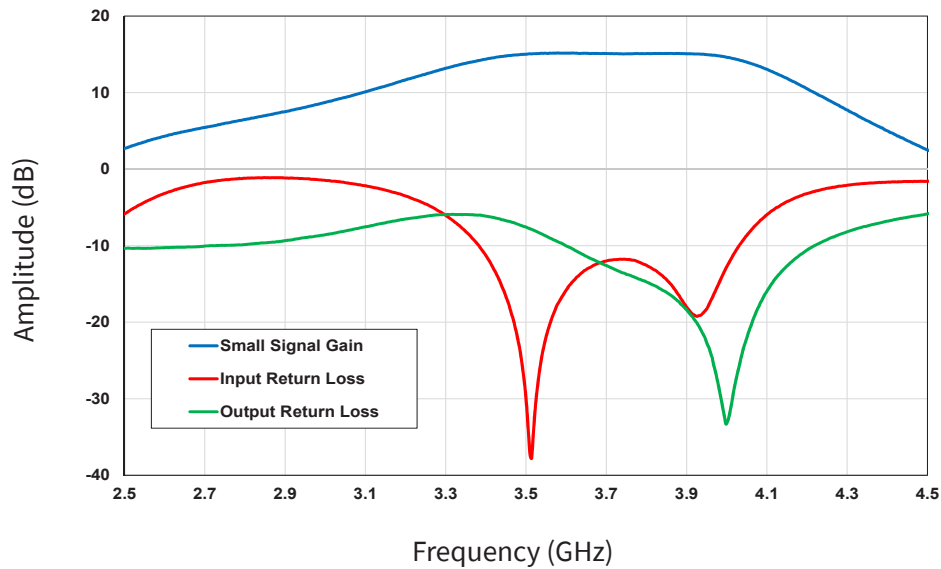
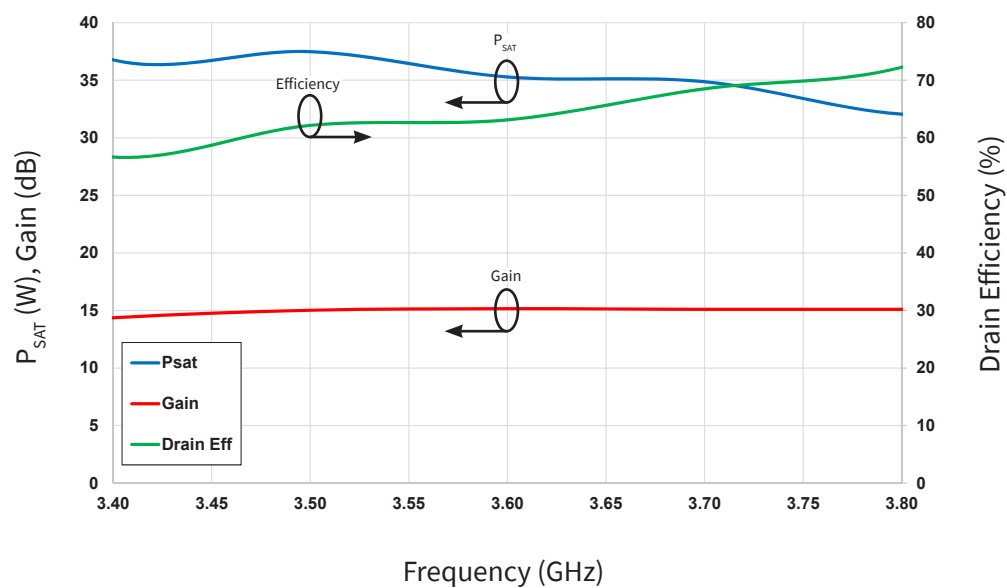


Figure 2. P_{SAT} , Gain, and Drain Efficiency vs Frequency of the CG2H40025F in the CG2H40025-AMP

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



Typical Performance

Figure 3. Swept CW Data of CG2H40025 vs. Output Power in CG2H40025-AMP
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 250\text{ mA}$, Freq = 3.6 GHz

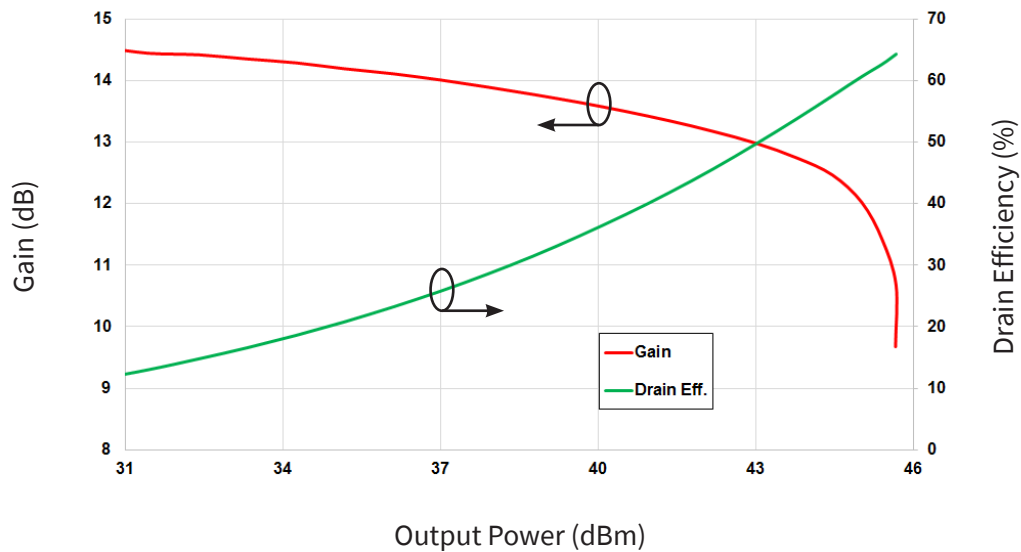
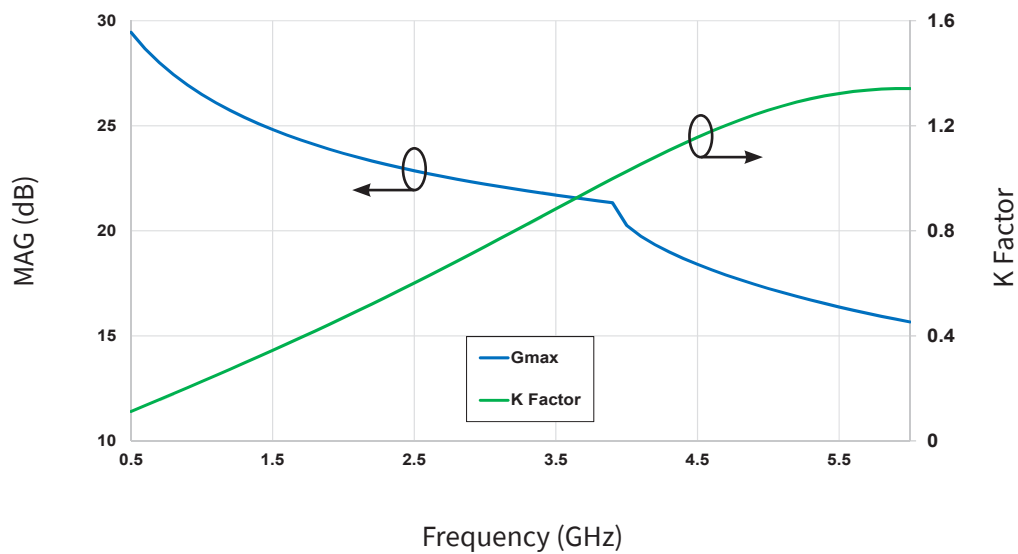
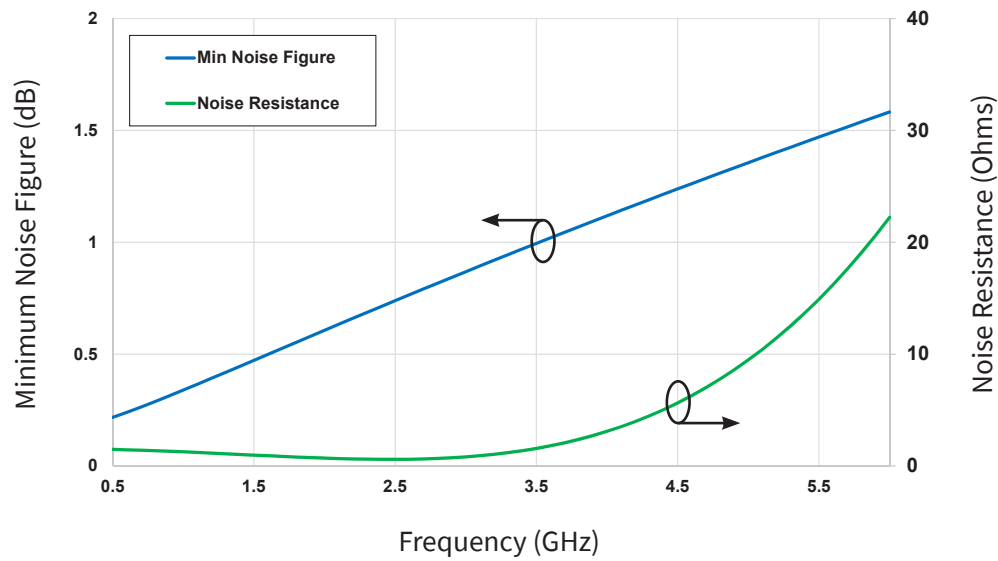


Figure 4. Maximum Available Gain and K Factor of the CG2H40025
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 250\text{ mA}$



Typical Noise Performance

Figure 5. Simulated Minimum Noise Figure and Noise Resistance vs Frequency of the CG2H40025F
 $V_{DD} = 28\text{ V}$, $I_{DQ} = 250\text{ mA}$

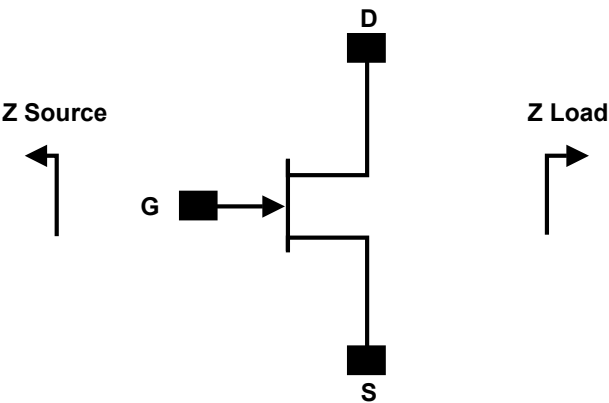


Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A > 250 V	JEDEC JESD22 A114-D
Charge Device Model	CDM	1 < 200 V	JEDEC JESD22 C101-C



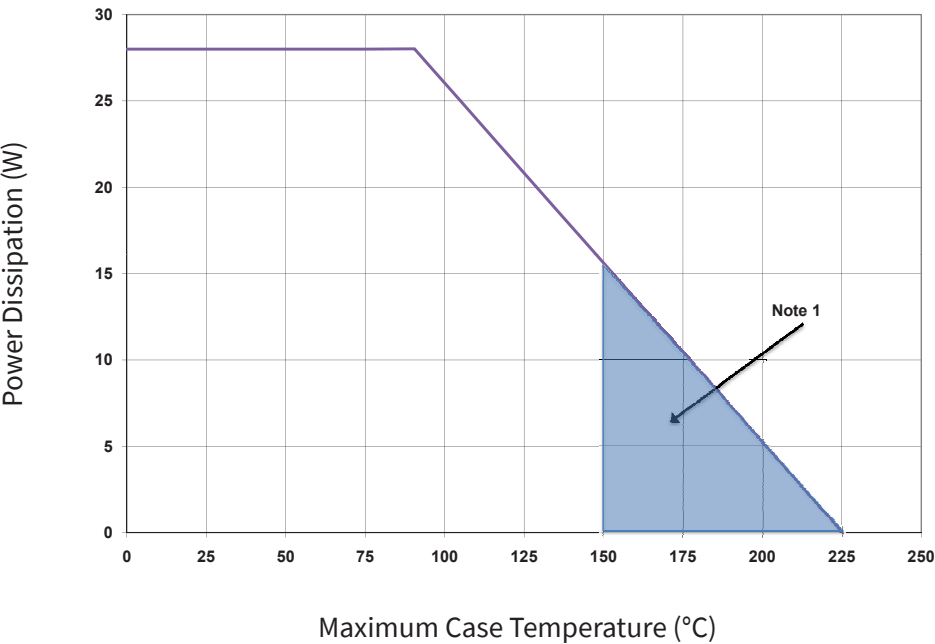
Source and Load Impedances



Frequency (MHz)	Z Source	Z Load
500	7.75 + j15.5	20 + j5.2
1000	3.11 + j5.72	17 + j6.66
1500	2.86 + j1.63	16.8 + j3.2
2500	2.4 - j3.52	8.02 + j4.32
3500	1.31 - j7.3	5.85 - j0.51

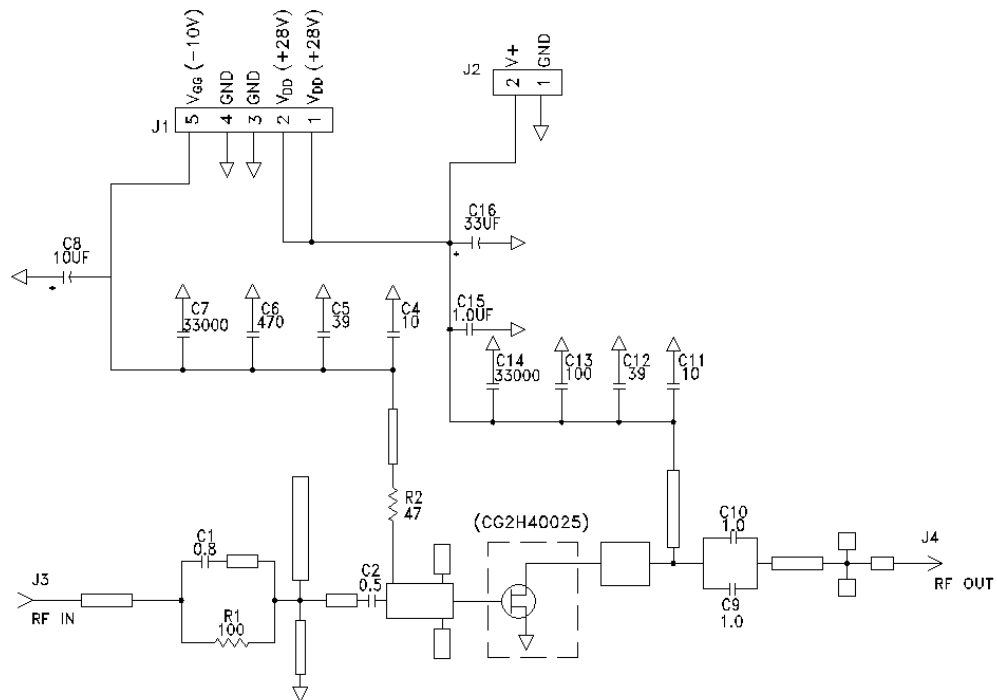
Note 1. $V_{DD} = 28V$, $I_{DQ} = 250mA$ in the 440166 package
Note 2. Optimized for P_{SAT} and PAE
Note 3. When using this device at low frequency, series resistors should be used to maintain amplifier stability

CG2H40025 Power Dissipation De-rating Curve

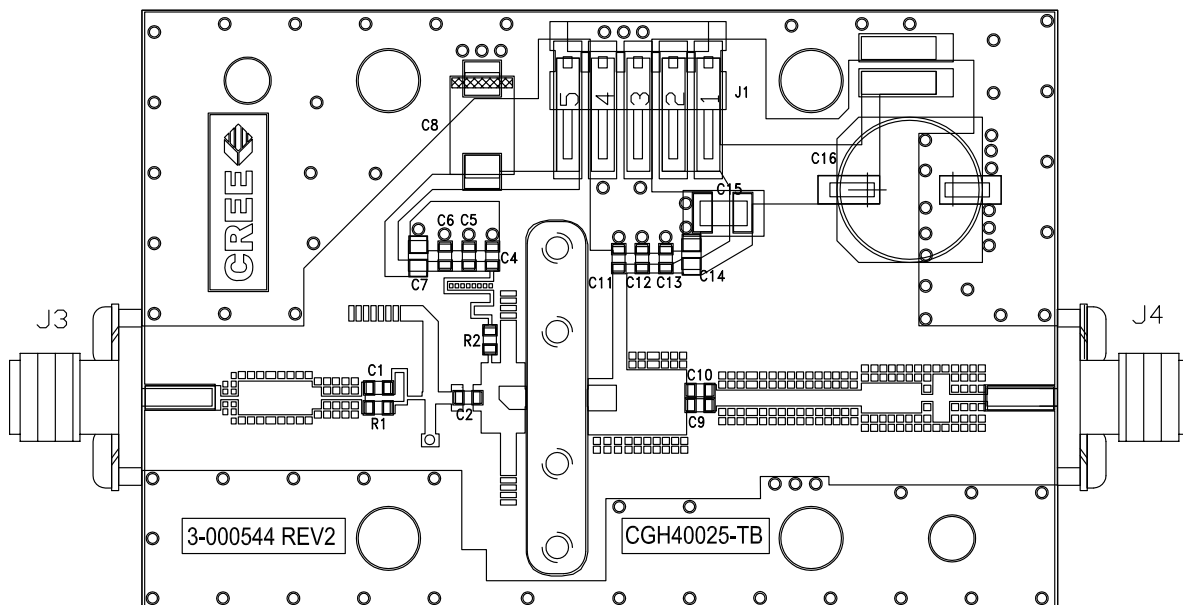


Note 1. Area exceeds Maximum Case Operating Temperature (See Page 2)

CG2H40025-AMP Demonstration Amplifier Circuit Schematic

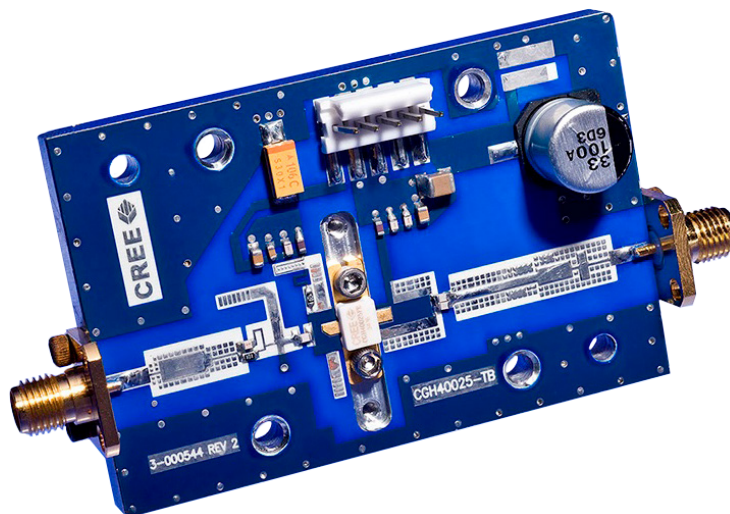


CG2H40025-AMP Demonstration Amplifier Circuit Outline



CG2H40025-AMP Demonstration Amplifier Circuit Bill of Materials

Designator	Description	Qty
R2	RES, 1/16W, 0603, 1%, 47 OHMS	1
R1	RES, 1/16W, 0603, 1%, 100 OHMS	1
C6	CAP, 470PF, 5%, 100V, 0603	1
C16	CAP, 33 UF, 20%, G CASE	1
C15	CAP, 1.0UF, 100V, 10%, X7R, 1210	1
C8	CAP 10UF 16V TANTALUM	1
C13	CAP, 100.0pF, +/-5%, 0603	1
C1	CAP, 0.8pF, +/-0.1pF, 0603	1
C2	CAP, 0.5pF, +/-0.05pF, 0603	1
C9, C10	CAP, 1.0pF, +/-0.1pF, 0603	2
C4, C11	CAP, 10.0pF, +/-5%, 0603	2
C5, C12	CAP, 39pF, +/-5%, 0603	2
C7, C14	CAP, 33000PF, 0805, 100V, X7R	2
J3, J4	CONN SMA STR PANEL JACK RECP	2
J1	HEADER RT>PLZ .1CEN LK 5POS	1
-	PCB, RO4350B, Er = 3.48, h = 20 mil	1
-	CG2H40025F or CG2H40025P	1

CG2H40025F-AMP Demonstration Amplifier Circuit



Typical Package S-Parameters for CG2H40025
(Small Signal, $V_{DS} = 28\text{ V}$, $I_{DQ} = 100\text{ mA}$, angle in degrees)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
0.5	0.869	-144.08	16.82	95.26	0.024	10.68	0.425	-137.01
0.6	0.864	-151.15	14.18	89.71	0.024	6.25	0.431	-142.15
0.7	0.861	-156.57	12.22	84.97	0.024	2.64	0.438	-145.82
0.8	0.859	-160.90	10.70	80.75	0.025	-0.43	0.446	-148.58
0.9	0.858	-164.50	9.49	76.90	0.025	-3.10	0.454	-150.76
1	0.857	-167.56	8.51	73.32	0.025	-5.46	0.463	-152.56
1.1	0.856	-170.23	7.70	69.96	0.025	-7.59	0.472	-154.11
1.2	0.856	-172.60	7.02	66.75	0.025	-9.52	0.482	-155.49
1.3	0.855	-174.74	6.43	63.69	0.025	-11.28	0.492	-156.77
1.4	0.855	-176.71	5.93	60.74	0.025	-12.87	0.502	-157.98
1.5	0.854	-178.52	5.49	57.88	0.025	-14.32	0.513	-159.15
1.6	0.854	-179.77	5.10	55.12	0.025	-15.64	0.523	-160.30
1.7	0.854	-178.17	4.76	52.43	0.025	-16.82	0.533	-161.43
1.8	0.854	-176.64	4.45	49.81	0.025	-17.86	0.543	-162.56
1.9	0.853	-175.18	4.18	47.25	0.025	-18.78	0.553	-163.69
2	0.853	-173.78	3.93	44.76	0.025	-19.56	0.562	-164.83
2.1	0.853	-172.43	3.70	42.32	0.025	-20.21	0.572	-165.97
2.2	0.853	-171.11	3.50	39.93	0.025	-20.73	0.581	-167.12
2.3	0.852	-169.83	3.31	37.59	0.025	-21.10	0.590	-168.28
2.4	0.852	-168.58	3.14	35.30	0.025	-21.33	0.599	-169.44
2.5	0.852	-167.35	2.98	33.06	0.025	-21.41	0.607	-170.61
2.6	0.851	-166.15	2.84	30.85	0.025	-21.34	0.615	-171.78
2.7	0.851	-164.96	2.70	28.69	0.025	-21.12	0.623	-172.96
2.8	0.851	-163.79	2.58	26.56	0.025	-20.73	0.630	-174.14
2.9	0.850	-162.64	2.47	24.48	0.025	-20.18	0.637	-175.32
3	0.850	-161.49	2.36	22.42	0.025	-19.47	0.644	-176.51
3.2	0.849	-159.23	2.17	18.42	0.025	-17.56	0.657	-178.89
3.4	0.848	-157.00	2.00	14.55	0.026	-15.02	0.669	-178.72
3.6	0.847	-154.78	1.85	10.79	0.027	-11.92	0.679	-176.34
3.8	0.845	-152.58	1.73	7.14	0.028	-8.41	0.689	-173.95
4	0.844	-150.37	1.61	3.60	0.029	-4.65	0.697	-171.56
4.2	0.843	-148.16	1.51	0.16	0.031	-0.86	0.705	-169.18
4.4	0.841	-145.94	1.42	-3.19	0.034	2.77	0.712	-166.79
4.6	0.839	-143.71	1.34	-6.44	0.037	6.05	0.718	-164.40
4.8	0.837	-141.46	1.27	-9.61	0.041	8.89	0.723	-162.00
5	0.835	-139.18	1.21	-12.69	0.046	11.21	0.728	-159.60
5.2	0.833	-136.87	1.15	-15.69	0.051	13.00	0.732	-157.18
5.4	0.830	-134.54	1.10	-18.61	0.057	14.29	0.735	-154.75
5.6	0.828	-132.16	1.05	-21.45	0.064	15.09	0.738	-152.31
5.8	0.825	-129.75	1.01	-24.21	0.072	15.47	0.740	-149.84
6	0.822	-127.30	0.97	-26.89	0.080	15.46	0.742	-147.35

To download the s-parameters in s2p format, go to the [CG2H40025](#) product page and click on the documentation tab.

Typical Package S-Parameters for CG2H40025
 (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
0.5	0.881	-151.40	18.76	93.94	0.017	12.31	0.488	-157.38
0.6	0.878	-157.62	15.77	89.14	0.018	9.22	0.495	-160.94
0.7	0.876	-162.40	13.57	85.03	0.018	6.84	0.501	-163.55
0.8	0.874	-166.25	11.89	81.37	0.018	4.92	0.505	-165.55
0.9	0.872	-169.47	10.56	78.02	0.018	3.33	0.510	-167.15
1	0.871	-172.24	9.49	74.89	0.018	1.99	0.515	-168.49
1.1	0.870	-174.67	8.60	71.93	0.019	0.84	0.519	-169.64
1.2	0.869	-176.86	7.86	69.10	0.019	-0.14	0.524	-170.66
1.3	0.867	-178.85	7.22	66.37	0.019	-0.99	0.529	-171.60
1.4	0.866	179.31	6.68	63.73	0.019	-1.72	0.534	-172.47
1.5	0.865	177.59	6.20	61.17	0.020	-2.33	0.539	-173.30
1.6	0.863	175.98	5.78	58.67	0.020	-2.84	0.544	-174.11
1.7	0.862	174.44	5.41	56.22	0.020	-3.26	0.549	-174.89
1.8	0.861	172.98	5.08	53.83	0.020	-3.58	0.554	-175.67
1.9	0.859	171.57	4.78	51.48	0.021	-3.81	0.559	-176.45
2	0.858	170.22	4.51	49.18	0.021	-3.95	0.564	-177.23
2.1	0.856	168.91	4.27	46.91	0.021	-4.00	0.569	-178.01
2.2	0.855	167.63	4.05	44.68	0.022	-3.97	0.574	-178.80
2.3	0.854	166.38	3.85	42.48	0.022	-3.86	0.579	-179.60
2.4	0.852	165.17	3.66	40.32	0.023	-3.67	0.584	179.58
2.5	0.850	163.97	3.49	38.19	0.023	-3.40	0.589	178.76
2.6	0.849	162.80	3.33	36.08	0.024	-3.06	0.593	177.93
2.7	0.847	161.64	3.19	34.01	0.024	-2.65	0.598	177.09
2.8	0.846	160.50	3.05	31.96	0.025	-2.18	0.602	176.23
2.9	0.844	159.38	2.93	29.94	0.025	-1.64	0.607	175.36
3	0.842	158.26	2.81	27.95	0.026	-1.05	0.611	174.48
3.2	0.839	156.06	2.60	24.03	0.027	0.26	0.619	172.70
3.4	0.836	153.89	2.41	20.21	0.029	1.71	0.627	170.87
3.6	0.832	151.74	2.25	16.47	0.031	3.23	0.634	169.01
3.8	0.829	149.60	2.10	12.82	0.033	4.77	0.640	167.11
4	0.825	147.46	1.97	9.25	0.036	6.24	0.646	165.18
4.2	0.821	145.33	1.86	5.75	0.039	7.61	0.651	163.22
4.4	0.817	143.19	1.76	2.33	0.043	8.82	0.656	161.23
4.6	0.814	141.03	1.66	-1.02	0.047	9.85	0.660	159.21
4.8	0.810	138.86	1.58	-4.31	0.051	10.66	0.664	157.17
5	0.806	136.67	1.51	-7.52	0.057	11.24	0.667	155.10
5.2	0.801	134.46	1.44	-10.68	0.062	11.59	0.669	153.00
5.4	0.797	132.22	1.38	-13.77	0.069	11.71	0.671	150.87
5.6	0.793	129.95	1.32	-16.80	0.076	11.60	0.673	148.72
5.8	0.788	127.64	1.27	-19.78	0.083	11.28	0.674	146.53
6	0.783	125.29	1.23	-22.69	0.092	10.74	0.675	144.31

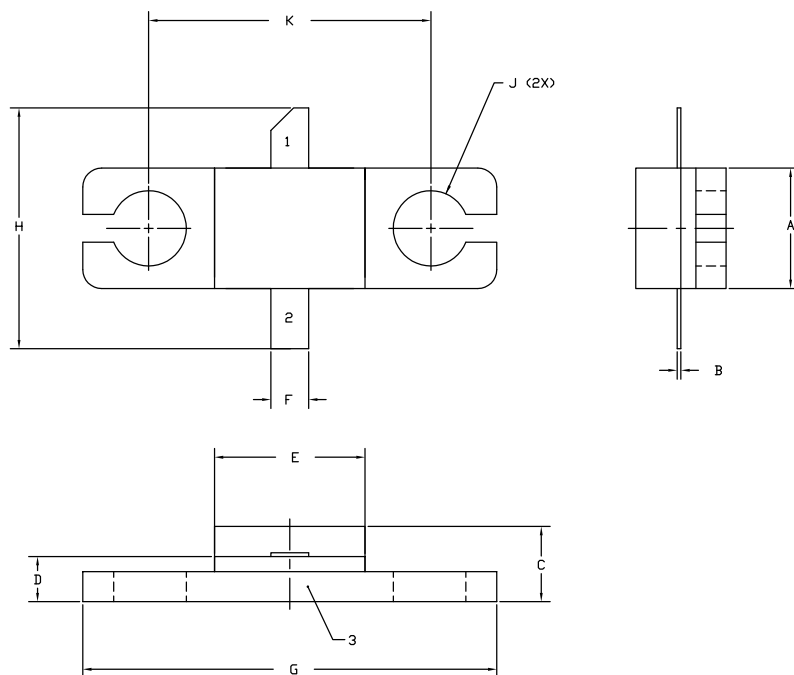
To download the s-parameters in s2p format, go to the [CG2H40025](#) product page and click on the documentation tab.

Typical Package S-Parameters for CG2H40025
(Small Signal, $V_{DS} = 28\text{ V}$, $I_{DQ} = 400\text{ mA}$, angle in degrees)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
0.5	0.891	-154.59	18.81	93.00	0.015	13.05	0.509	-162.83
0.6	0.888	-160.39	15.79	88.47	0.015	10.57	0.515	-165.80
0.7	0.886	-164.86	13.57	84.59	0.015	8.73	0.519	-168.00
0.8	0.885	-168.47	11.89	81.12	0.016	7.31	0.524	-169.72
0.9	0.883	-171.51	10.56	77.93	0.016	6.19	0.527	-171.12
1	0.882	-174.13	9.49	74.94	0.016	5.28	0.531	-172.30
1.1	0.881	-176.46	8.61	72.11	0.016	4.55	0.535	-173.34
1.2	0.879	-178.55	7.87	69.39	0.017	3.95	0.538	-174.27
1.3	0.878	-179.53	7.23	66.77	0.017	3.47	0.542	-175.12
1.4	0.876	-177.75	6.69	64.23	0.017	3.08	0.546	-175.93
1.5	0.875	-176.09	6.22	61.76	0.017	2.79	0.550	-176.70
1.6	0.873	-174.52	5.80	59.34	0.018	2.57	0.554	-177.44
1.7	0.872	-173.02	5.43	56.97	0.018	2.43	0.558	-178.17
1.8	0.870	-171.58	5.11	54.65	0.019	2.36	0.562	-178.90
1.9	0.869	-170.20	4.81	52.36	0.019	2.35	0.566	-179.62
2	0.867	-168.87	4.55	50.12	0.019	2.41	0.570	-179.65
2.1	0.865	-167.57	4.30	47.91	0.020	2.52	0.574	-178.93
2.2	0.864	-166.31	4.08	45.73	0.020	2.69	0.578	-178.19
2.3	0.862	-165.08	3.88	43.58	0.021	2.91	0.582	-177.45
2.4	0.860	-163.87	3.70	41.46	0.021	3.18	0.586	-176.69
2.5	0.858	-162.68	3.53	39.36	0.022	3.50	0.590	-175.93
2.6	0.856	-161.52	3.37	37.30	0.023	3.86	0.594	-175.15
2.7	0.854	-160.37	3.23	35.26	0.023	4.25	0.597	-174.37
2.8	0.852	-159.23	3.09	33.24	0.024	4.68	0.601	-173.57
2.9	0.850	-158.11	2.97	31.25	0.025	5.14	0.605	-172.76
3	0.848	-157.00	2.85	29.28	0.026	5.62	0.608	-171.94
3.2	0.844	-154.81	2.64	25.40	0.028	6.63	0.615	-170.27
3.4	0.840	-152.64	2.46	21.61	0.030	7.66	0.621	-168.56
3.6	0.836	-150.50	2.29	17.90	0.032	8.69	0.627	-166.80
3.8	0.832	-148.36	2.15	14.26	0.035	9.67	0.632	-165.01
4	0.828	-146.23	2.02	10.70	0.038	10.55	0.637	-163.18
4.2	0.823	-144.10	1.91	7.20	0.041	11.32	0.641	-161.32
4.4	0.819	-141.97	1.80	3.78	0.045	11.94	0.645	-159.43
4.6	0.814	-139.82	1.71	0.41	0.050	12.40	0.649	-157.50
4.8	0.810	-137.66	1.63	-2.89	0.055	12.68	0.652	-155.54
5	0.805	-135.48	1.55	-6.13	0.060	12.79	0.654	-153.56
5.2	0.800	-133.27	1.48	-9.30	0.066	12.71	0.656	-151.54
5.4	0.795	-131.04	1.42	-12.43	0.073	12.45	0.658	-149.49
5.6	0.790	-128.78	1.37	-15.49	0.080	12.01	0.659	-147.40
5.8	0.785	-126.49	1.32	-18.50	0.088	11.40	0.660	-145.28
6	0.779	-124.15	1.27	-21.45	0.096	10.62	0.660	-143.13

To download the s-parameters in s2p format, go to the [CG2H40025](#) product page and click on the documentation tab.

Product Dimensions CG2H40025F (Package Type — 440166)



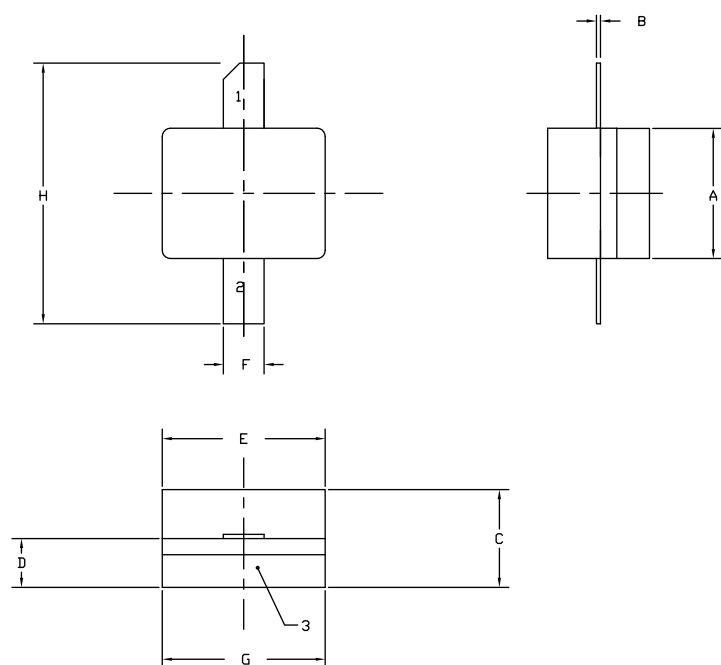
NOTES:

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	0.155	0.165	3.94	4.19
B	0.004	0.006	0.10	0.15
C	0.115	0.135	2.92	3.43
D	0.057	0.067	1.45	1.70
E	0.195	0.205	4.95	5.21
F	0.045	0.055	1.14	1.40
G	0.545	0.555	13.84	14.09
H	0.280	0.360	7.11	9.14
J	Ø .100		2.54	
K	0.375		9.53	

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

Product Dimensions CG2H40025P (Package Type — 440196)



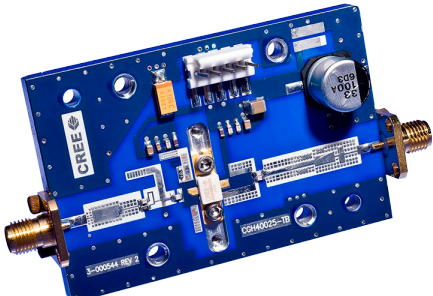
NOTES:

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	0.155	0.165	3.94	4.19
B	0.003	0.006	0.10	0.15
C	0.115	0.135	2.92	3.17
D	0.057	0.067	1.45	1.70
E	0.195	0.205	4.95	5.21
F	0.045	0.055	1.14	1.40
G	0.195	0.205	4.95	5.21
H	0.280	0.360	7.11	9.14

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

**Product Ordering Information**

Order Number	Description	Unit of Measure	Image
CG2H40025F	GaN HEMT	Each	
CG2H40025P	GaN HEMT	Each	
CG2H40025F-AMP	Test board with GaN HEMT installed	Each	

For more information, please contact:

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Durham, North Carolina, USA 27703
www.wolfspeed.com/RF

Sales Contact
RFSales@cree.com

Notes

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