

# CG2H40025

## 25 W, 28 V RF Power GaN HEMT

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.



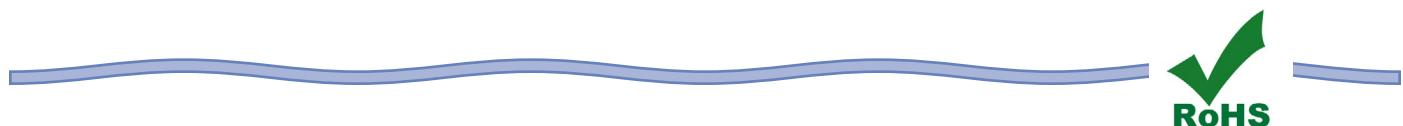
Package Type: 440196 and 440166  
PN: CG2H40025P and CG2H40025F

### 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



Large Signal Models Available for ADS and MWO

## 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 <sup>1</sup>	$I_{DMAX}$	3	A	25°C
Soldering Temperature <sup>2</sup>	$T_S$	245	°C	
Screw Torque	$\tau$	60	in-oz	
Thermal Resistance, Junction to Case <sup>3</sup>	$R_{tJC}$	3.8	°C/W	85°C
Case Operating Temperature <sup>3,4</sup>	$T_c$	-40, +150	°C	

Note:

<sup>1</sup> Current limit for long term, reliable operation

<sup>2</sup> Refer to the Application Note on soldering at [www.cree.com/RF/Document-Library](http://www.cree.com/RF/Document-Library)

<sup>3</sup> Measured for the CG2H40025F at  $P_{DISS} = 28.8\text{ W}$ .

<sup>4</sup> 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
<b>DC Characteristics<sup>1</sup></b>						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	$V_{DC}$	$V_{DS} = 10\text{ V}, I_D = 7.2\text{ mA}$
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	$V_{DC}$	$V_{DS} = 28\text{ V}, I_D = 250\text{ mA}$
Saturated Drain Current	$I_{DS}$	5.8	7.0	-	A	$V_{DS} = 6.0\text{ V}, V_{GS} = 2.0\text{ V}$
Drain-Source Breakdown Voltage	$V_{BR}$	120	-	-	$V_{DC}$	$V_{GS} = -8\text{ V}, I_D = 7.2\text{ mA}$
<b>RF Characteristics<sup>2</sup> (<math>T_c = 25^\circ\text{C}, f_0 = 3.7\text{ GHz}</math> unless otherwise noted)</b>						
Small Signal Gain	$G_{SS}$	13.0	14.8	-	dB	$V_{DD} = 28\text{ V}, I_{DQ} = 250\text{ mA}$
Power Output <sup>3</sup>	$P_{SAT}$	25	34	-	W	$V_{DD} = 28\text{ V}, I_{DQ} = 250\text{ mA}$
Drain Efficiency <sup>4</sup>	$\eta$	57	71	-	%	$V_{DD} = 28\text{ V}, I_{DQ} = 250\text{ mA}, P_{SAT}$
Output Mismatch Stress	VSWR	-	-	10 : 1	$\Psi$	No damage at all phase angles, $V_{DD} = 28\text{ V}, I_{DQ} = 250\text{ mA},$ $P_{OUT} = 25\text{ W CW}$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{GS}$	-	7.5	-	pF	$V_{DS} = 28\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$
Output Capacitance	$C_{DS}$	-	2.4	-	pF	$V_{DS} = 28\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$
Feedback Capacitance	$C_{GD}$	-	0.4	-	pF	$V_{DS} = 28\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$

Notes:

<sup>1</sup> Measured on wafer prior to packaging.

<sup>2</sup> Measured in CG2H40025-AMP.

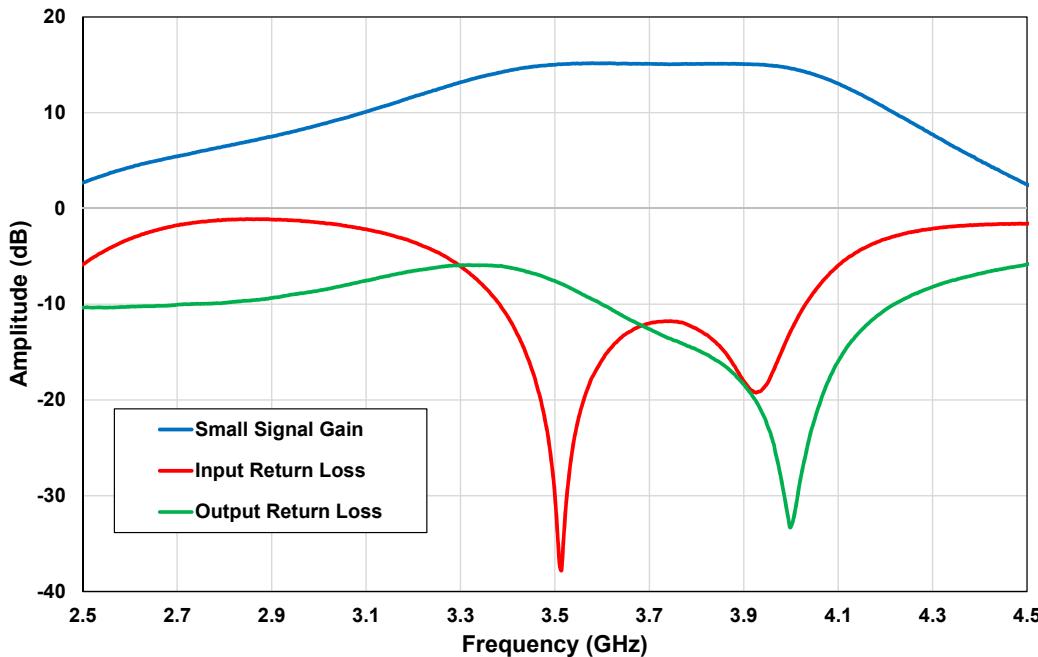
<sup>3</sup>  $P_{SAT}$  is defined as  $I_G = 0.72\text{ mA}$ .

<sup>4</sup> Drain Efficiency =  $P_{OUT} / P_{DC}$

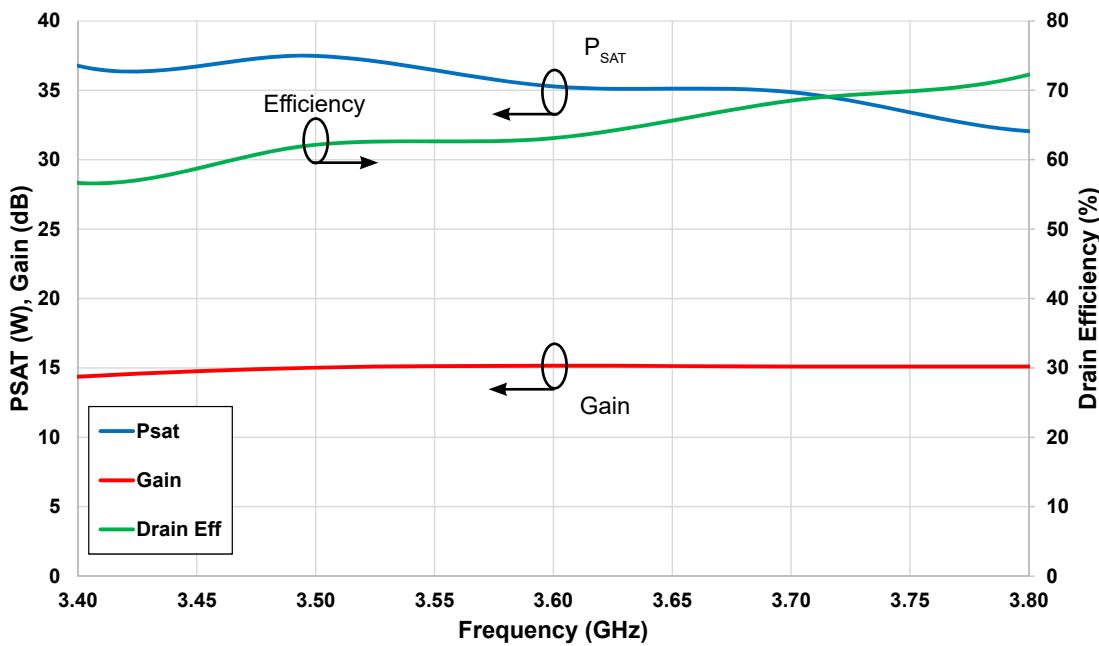
## Typical Performance



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



## Typical Performance



Figure 3. - Swept CW Data of CG2H40025 vs. Output Power in CG2H40025-AMP

$V_{DD} = 28$  V,  $I_{DQ} = 250$  mA, Freq = 3.6 GHz

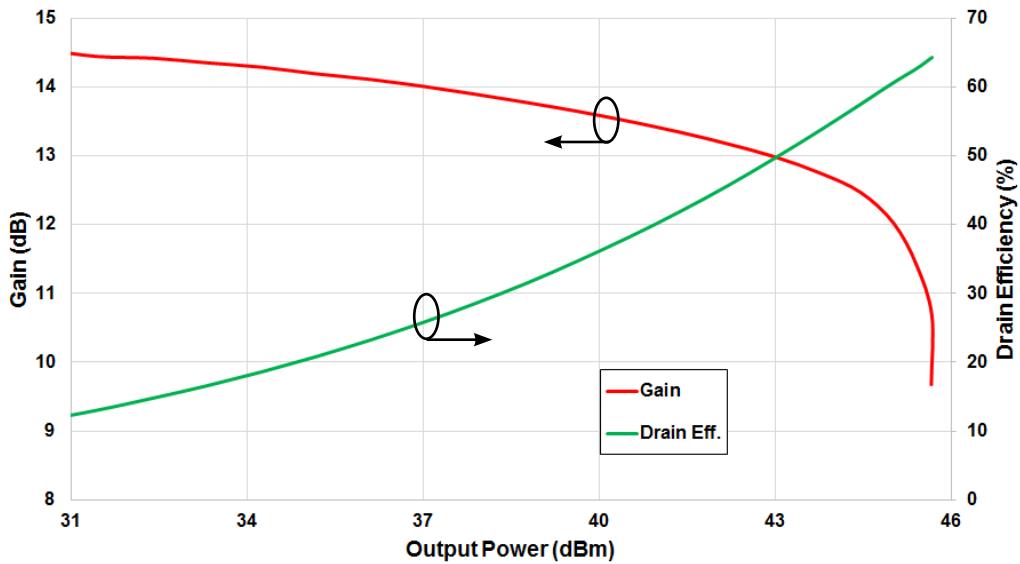
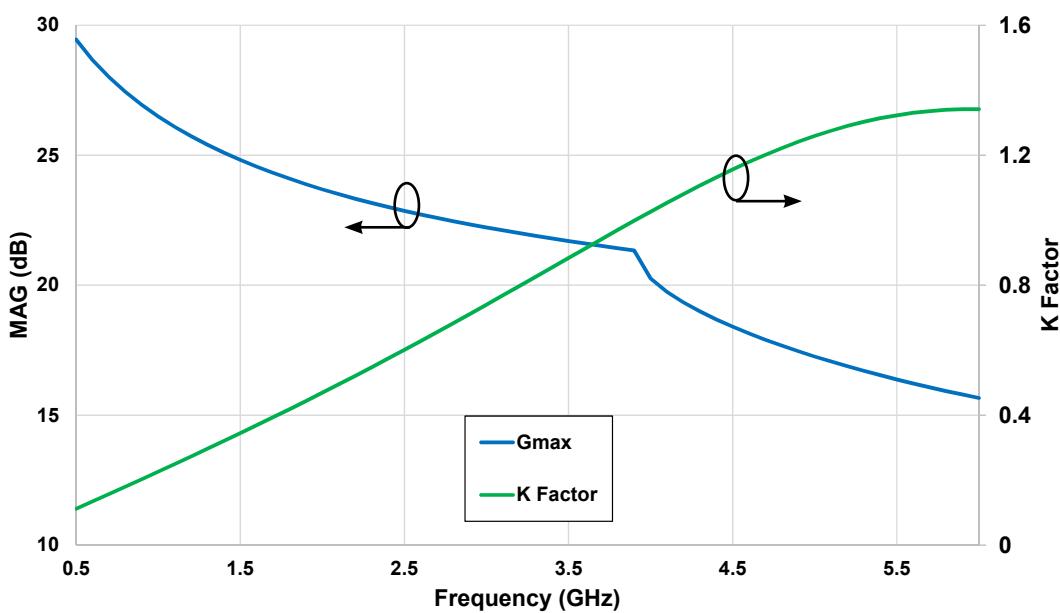


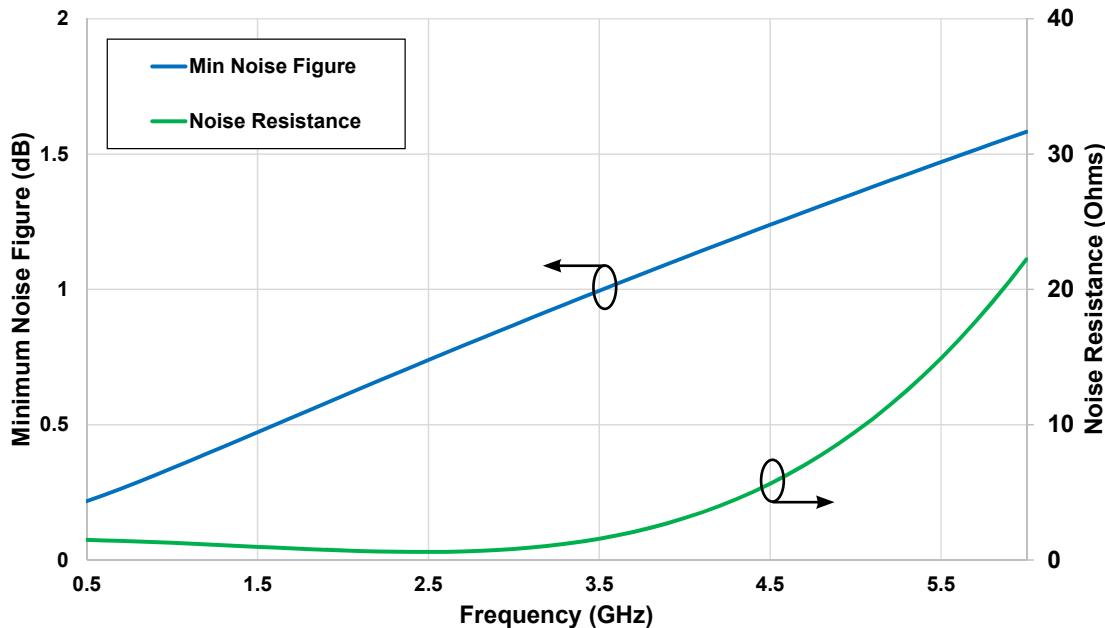
Figure 4. - Maximum Available Gain and K Factor of the CG2H40025

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



## Typical Noise Performance

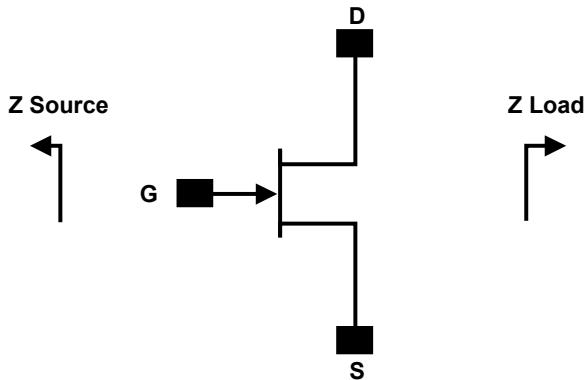
**Figure 5. - Simulated Minimum Noise Figure and Noise Resistance vs Frequency of the CG2H40025F**  
 $V_{DD} = 28 \text{ V}$ ,  $I_{DQ} = 250 \text{ mA}$



## 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



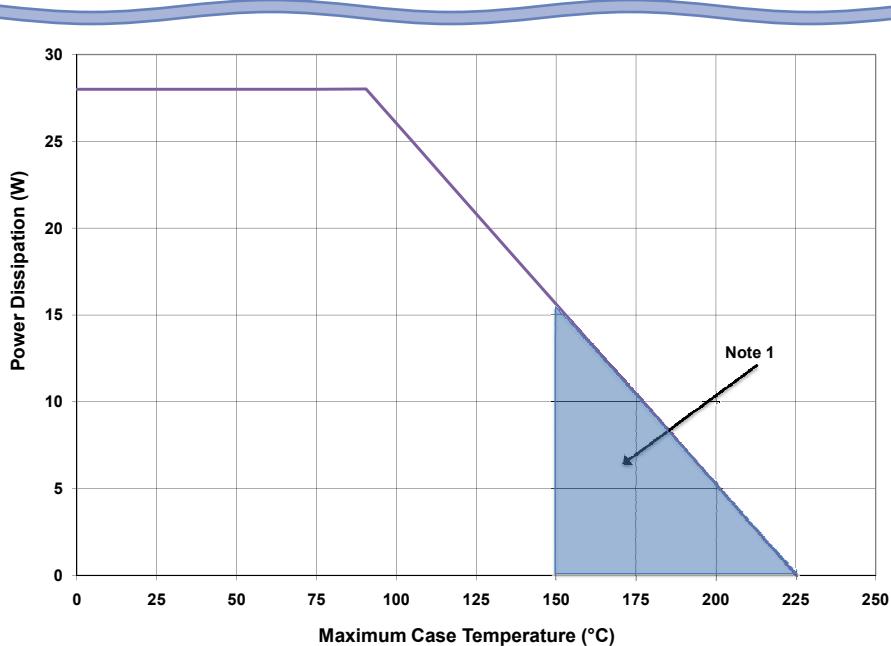
Frequency (MHz)	Z Source	Z Load
500	$7.75 + j15.5$	$20 + j5.2$
1000	$3.11 + j5.72$	$17 + j6.66$
1500	$2.86 + j1.63$	$16.8 + j3.2$
2500	$2.4 - j3.52$	$8.02 + j4.32$
3500	$1.31 - j7.3$	$5.85 - j0.51$

Note 1.  $V_{DD} = 28V$ ,  $I_{DQ} = 250mA$  in the 440166 package.

Note 2. Optimized for power gain,  $P_{SAT}$  and PAE.

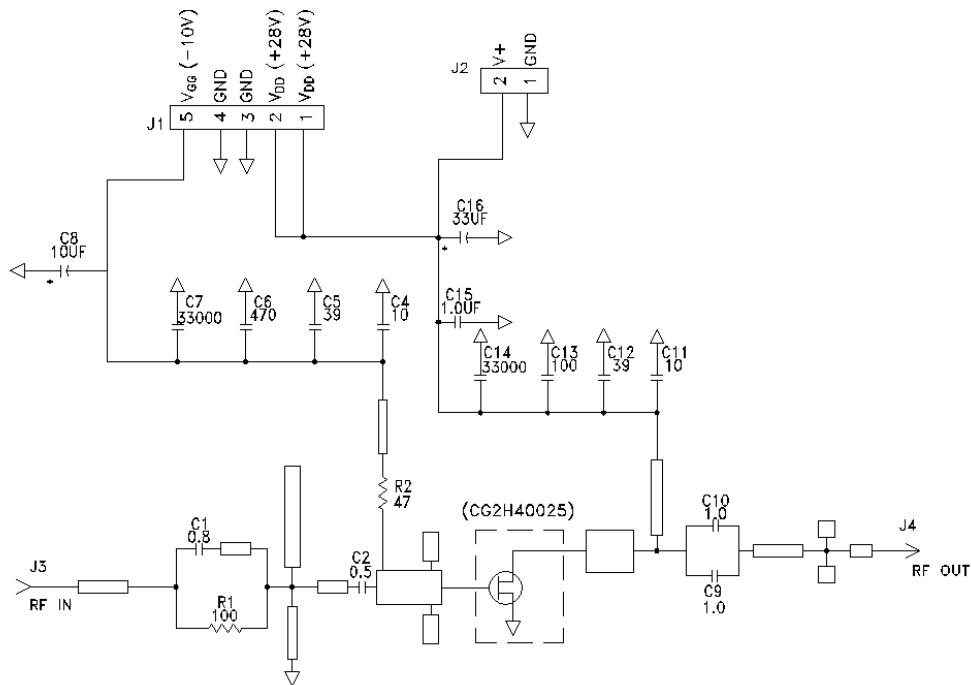
Note 3. When using this device at low frequency, series resistors should be used to maintain amplifier stability.

## CG2H40025 Power Dissipation De-rating Curve

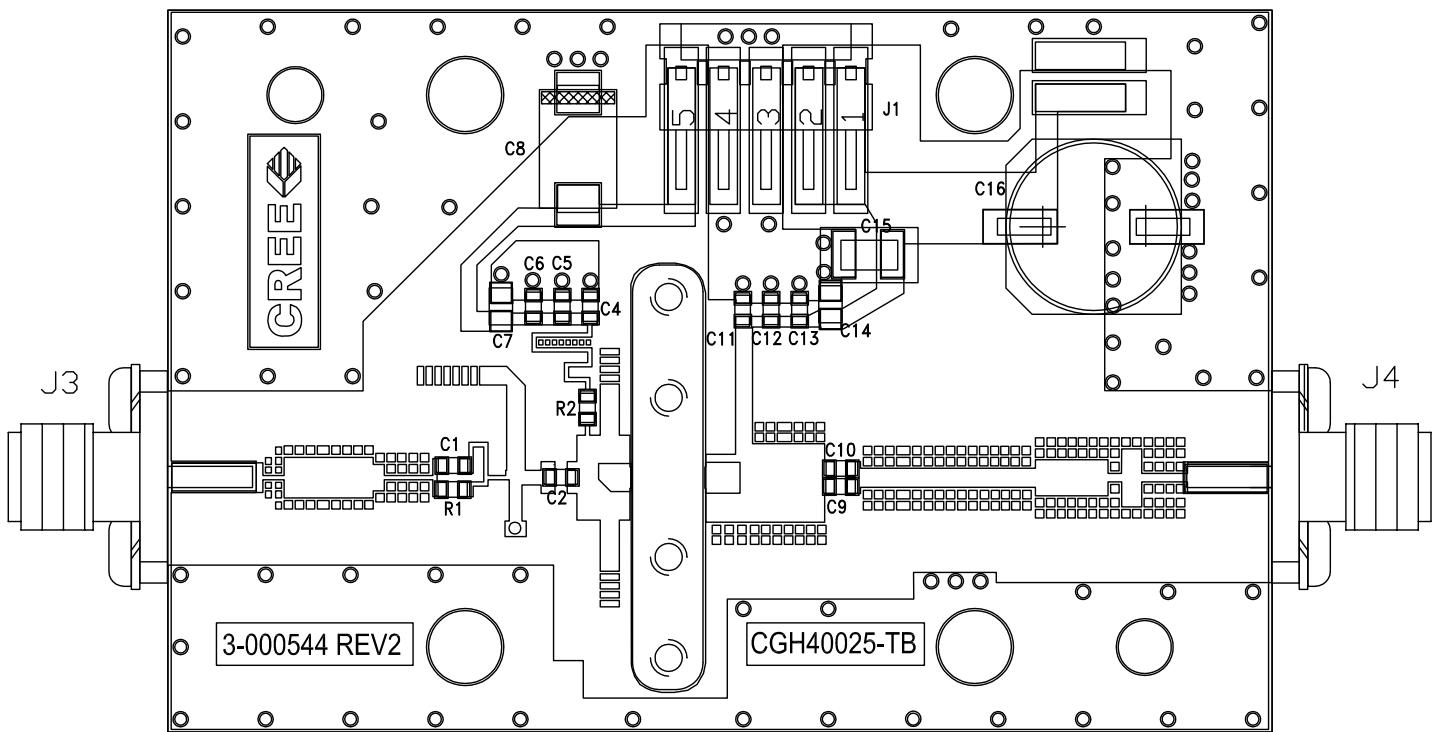


Note 1. Area exceeds Maximum Case Operating Temperature (See Page 2).

## CG2H40025-AMP Demonstration Amplifier Circuit Schematic



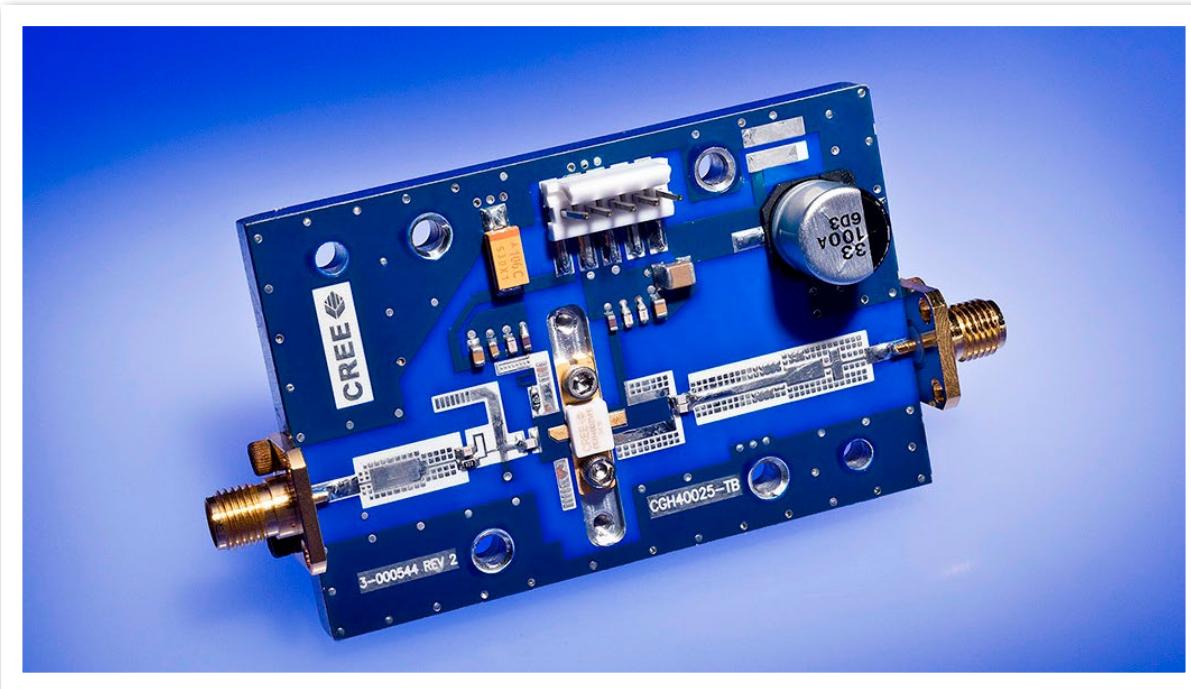
## CG2H40025-AMP Demonstration Amplifier Circuit Outline



## 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,  $V_{DS} = 28$  V,  $I_{DQ} = 100$  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

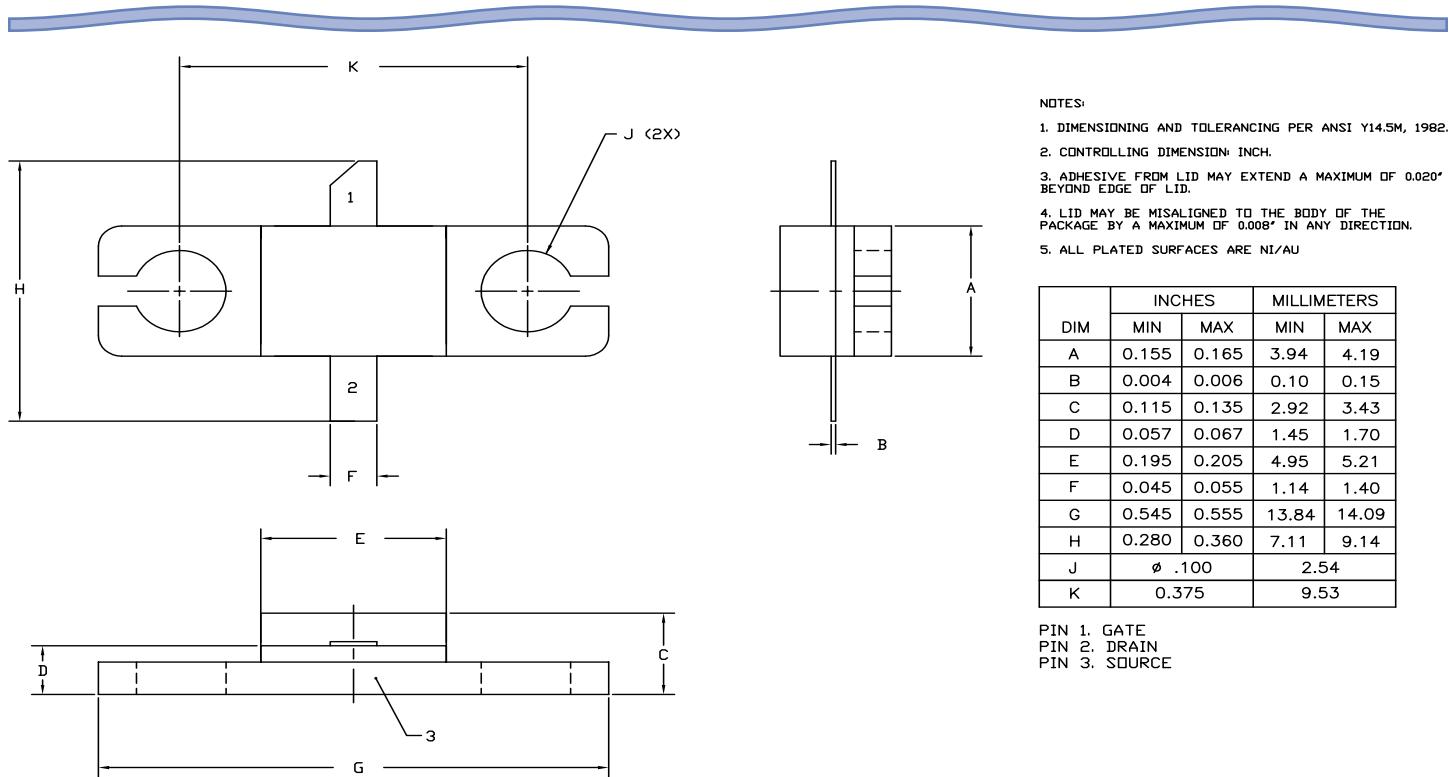
**Typical Package S-Parameters for CG2H40025  
(Small Signal,  $V_{DS} = 28$  V,  $I_{DQ} = 250$  mA, angle in degrees)**

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

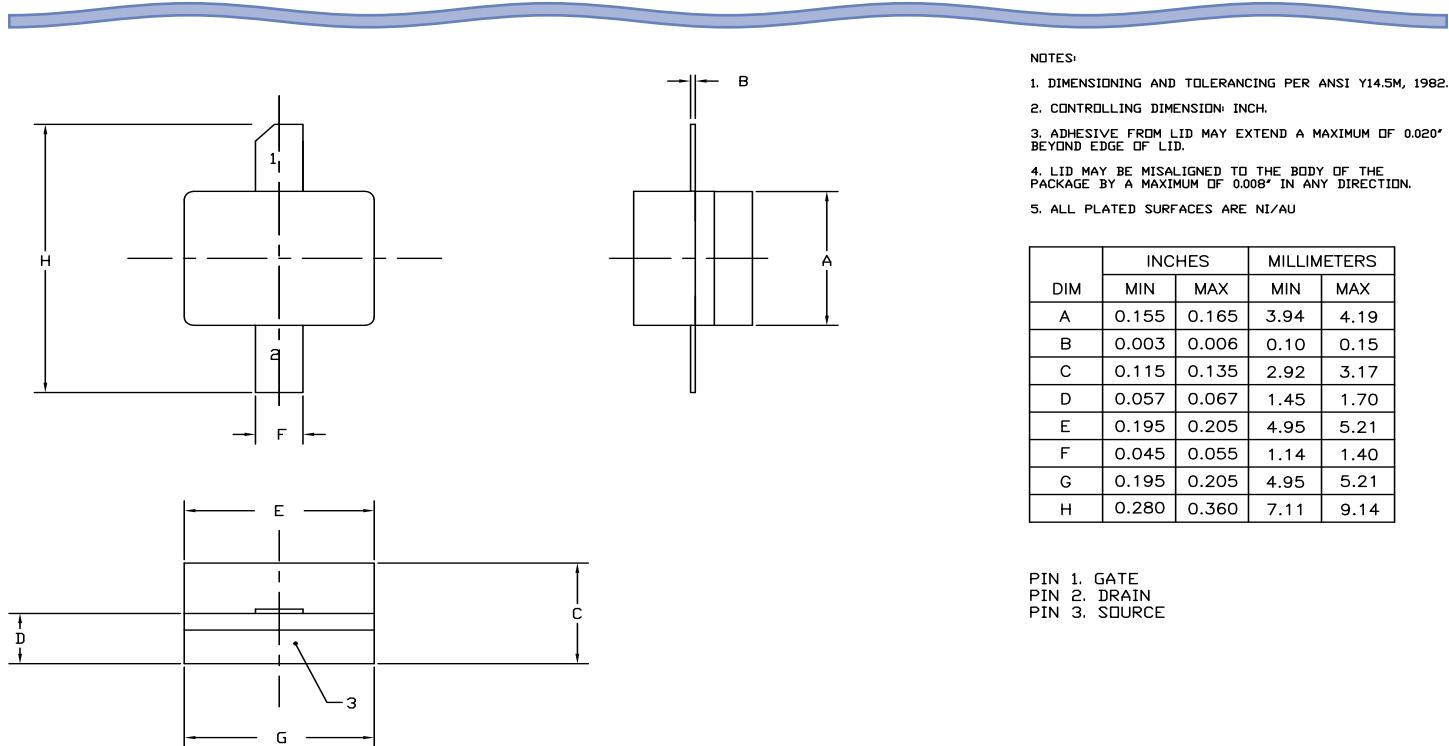
**Typical Package S-Parameters for CG2H40025  
(Small Signal,  $V_{DS} = 28$  V,  $I_{DQ} = 400$  mA, angle in degrees)**

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

## Product Dimensions CG2H40025F (Package Type – 440166)



## Product Dimensions CG2H40025P (Package Type – 440196)



## Product Ordering Information

Order Number	Description	Unit of Measure	Image
CG2H40025F	GaN HEMT	Each	
CG2H40025P	GaN HEMT	Each	
CG2H40025F-TB	Test board without GaN HEMT	Each	
CG2H40025F-AMP	Test board with GaN HEMT installed	Each	

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ООО "ЛайфЭлектроникс"

"LifeElectronics" LLC

ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703

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Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
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- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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