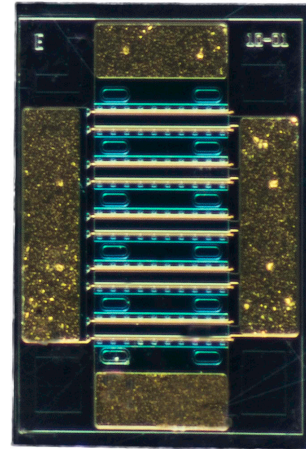


# CG2H80015D

15 W, 8.0 GHz, GaN HEMT Die

## Description

Cree's CG2H80015D is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT). GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity, and higher thermal conductivity. GaN HEMTs offer greater power density and wider bandwidths compared to Si and GaAs transistors



PN: CG2H80015D

## Features

- 17 dB Typical Small Signal Gain at 4 GHz
- 12 dB Typical Small Signal Gain at 8 GHz
- 15 W Typical  $P_{SAT}$
- 28 V Operation
- High Breakdown Voltage
- High Temperature Operation
- Up to 8 GHz Operation
- High Efficiency

## Applications

- 2-Way Private Radio
- Broadband Amplifiers
- Cellular infrastructure
- Test Instrumentation
- Class A, AB, Linear amplifiers suitable for OFDM, W-CDMA, EDGE, CDMA waveforms

## Packaging Information



- Bare die are shipped in Gel-Pak® containers
- Non-adhesive tacky membrane immobilizes die during shipment

 Large Signal Models Available for ADS and MWO

**RoHS**  
COMPLIANT



### 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	$I_{GMAX}$	4.0	mA	25 °C
Maximum Drain Current <sup>1</sup>	$I_{DMAX}$	1.5	A	25 °C
Thermal Resistance, Junction to Case (packaged) <sup>2</sup>	$R_{\theta JC}$	8.0	°C/W	
Thermal Resistance, Junction to Case (die only)	$R_{\theta JC}$	5.1	°C/W	
Mounting Temperature (30 seconds)	$T_S$	320	°C	30 seconds

Notes:

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

<sup>2</sup> Eutectic die attach using 80/20 AuSn mounted to a 40 mil thick CuMoCu carrier

### Electrical Characteristics (Frequency = 4 GHz unless otherwise stated; $T_c = 25 °C$ )

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	-3.8	-3.0	-2.3	$V_{DC}$	$V_{DS} = 10 V, I_D = 3.6 mA$
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	$V_{DC}$	$V_{DD} = 28 V, I_{DQ} = 100 mA$
Saturated Drain Current	$I_{DS}$	2.9	3.5	-	A	$V_{DS} = 6.0 V, V_{GS} = 2.0 V$
Drain-Source Breakdown Voltage	$V_{BD}$	84	-	-	$V_{DC}$	$V_{GS} = -8 V, I_D = 3.6 mA$
On Resistance	$R_{ON}$	-	0.67	-	$\Omega$	$V_{DS} = 0.1 V$
Gate Forward Voltage	$V_{G-ON}$	-	1.9	-	V	$I_{GS} = 3.6 mA$
<b>RF Characteristics</b>						
Small Signal Gain	$G_{SS}$	-	17	-	dB	$V_{DD} = 28 V, I_{DQ} = 100 mA$
Output Power <sup>1</sup>	$P_{SAT}$	-	15	-	W	$V_{DD} = 28 V, I_{DQ} = 100 mA$
Drain Efficiency <sup>2</sup>	$\eta$	-	65	-	%	$V_{DD} = 28 V, I_{DQ} = 100 mA, P_{SAT} = 15 W$
Intermodulation Distortion	IM3	-	-30	-	dBc	$V_{DD} = 28 V, I_{DQ} = 100 mA, P_{OUT} = 15 W PEP$
Output Mismatch Stress <sup>3</sup>	VSWR	-	-	10 : 1	$\Psi$	$V_{DD} = 28 V, I_{DQ} = 100 mA, P_{OUT} = 15 W CW$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{GS}$	-	3.7	-	pF	$V_{DS} = 28 V, V_{GS} = -8 V, f = 1 MHz$
Output Capacitance	$C_{DS}$	-	1.1	-	pF	$V_{DS} = 28 V, V_{GS} = -8 V, f = 1 MHz$
Feedback Capacitance	$C_{GD}$	-	0.2	-	pF	$V_{DS} = 28 V, V_{GS} = -8 V, f = 1 MHz$

Notes:

<sup>1</sup>  $P_{SAT}$  is defined as  $I_G = 0.4 mA$

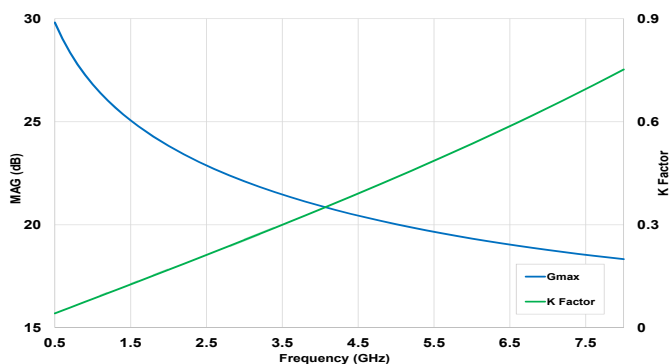
<sup>2</sup> Drain Efficiency =  $P_{OUT} / P_{DC}$

<sup>3</sup> No damage at all phase angles

## Typical Performance

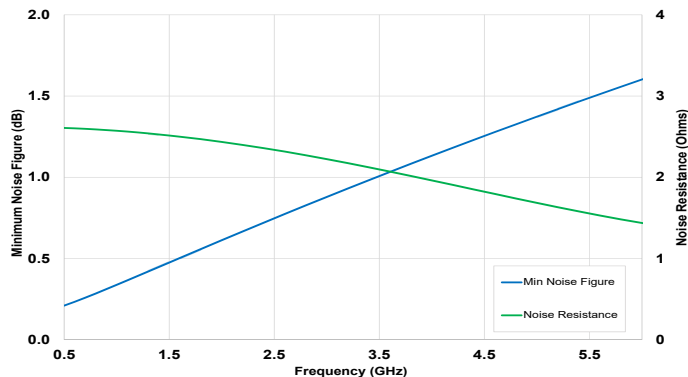
### Simulated Maximum Available Gain and K Factor

$$V_{DD} = 28 \text{ V}, I_{DQ} = 200 \text{ mA}$$



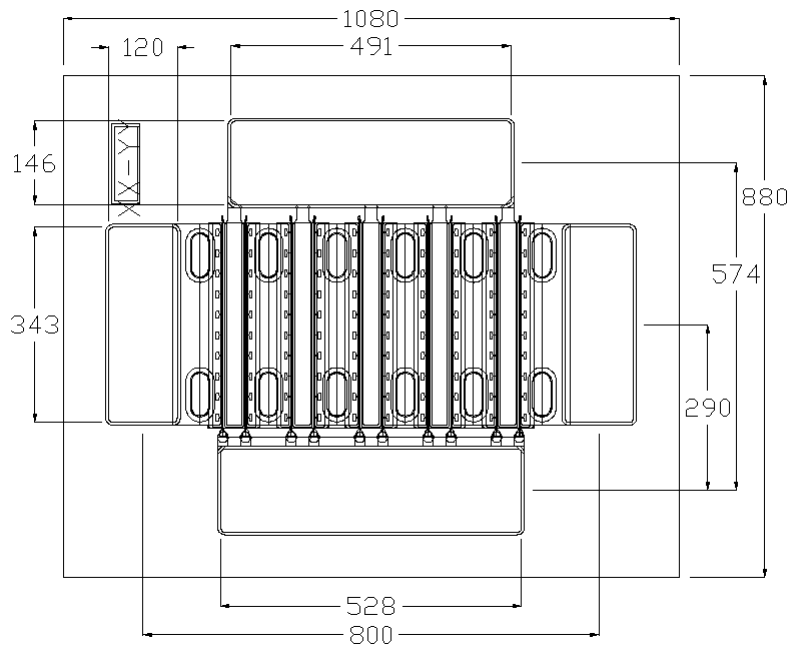
### Simulated Minimum Noise Figure and Noise Resistance vs. Frequency

$$V_{DD} = 28 \text{ V}, I_{DQ} = 200 \text{ mA}$$



Intrinsic die parameters - reference planes at centers of gate and drain bonding pads. No wire bonds assumed.

### Die Dimensions (units in microns)



### Assembly Notes:

- Recommended solder is AuSn (80/20) solder. Refer to Cree's website for the Eutectic Die Bond Procedure application note at <https://www.wolfspeed.com/rf/document-library>
- Vacuum collet is the preferred method of pick-up.
- The backside of the die is the Source (ground) contact.
- Die back side gold plating is 5 microns thick minimum.
- Thermosonic ball or wedge bonding are the preferred connection methods.
- Gold wire must be used for connections.
- Use the die label (XX-YY) for correct orientation.



**Typical Package S-Parameters for CG2H80015D**  
**(Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 100\text{ mA}$ , magnitude / angle)**

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
0.5	0.909	-110.59	21.66	117.76	0.030	28.48	0.437	-96.69
0.6	0.900	-120.05	18.90	112.17	0.031	23.04	0.426	-105.26
0.7	0.893	-127.43	16.69	107.63	0.032	18.63	0.419	-111.87
0.8	0.889	-133.31	14.89	103.82	0.033	14.98	0.414	-117.03
0.9	0.885	-138.08	13.41	100.56	0.033	11.86	0.412	-121.10
1.0	0.883	-142.02	12.18	97.71	0.034	9.15	0.412	-124.36
1.1	0.881	-145.32	11.15	95.16	0.034	6.75	0.413	-126.99
1.2	0.880	-148.13	10.26	92.86	0.034	4.59	0.415	-129.14
1.3	0.879	-150.55	9.50	90.74	0.034	2.62	0.418	-130.90
1.4	0.879	-152.65	8.83	88.79	0.034	0.80	0.421	-132.37
1.5	0.879	-154.49	8.25	86.95	0.034	-0.89	0.425	-133.61
1.6	0.878	-156.12	7.73	85.23	0.034	-2.47	0.430	-134.65
1.8	0.879	-158.88	6.86	82.02	0.034	-5.38	0.440	-136.33
2.0	0.879	-161.14	6.15	79.08	0.034	-8.03	0.451	-137.62
2.2	0.880	-163.03	5.57	76.35	0.034	-10.48	0.463	-138.66
2.4	0.881	-164.63	5.07	73.77	0.033	-12.77	0.476	-139.54
2.6	0.883	-166.03	4.65	71.32	0.033	-14.93	0.489	-140.32
2.8	0.884	-167.26	4.28	68.98	0.033	-16.98	0.502	-141.04
3.0	0.886	-168.35	3.97	66.73	0.032	-18.94	0.516	-141.72
3.2	0.887	-169.34	3.69	64.57	0.032	-20.81	0.530	-142.39
3.4	0.889	-170.24	3.44	62.48	0.032	-22.61	0.543	-143.05
3.6	0.891	-171.07	3.21	60.45	0.031	-24.34	0.556	-143.71
3.8	0.893	-171.84	3.01	58.49	0.031	-26.01	0.570	-144.37
4.0	0.895	-172.57	2.83	56.59	0.030	-27.62	0.583	-145.03
4.2	0.896	-173.25	2.67	54.74	0.030	-29.17	0.595	-145.70
4.4	0.898	-173.90	2.52	52.94	0.030	-30.68	0.608	-146.37
4.6	0.900	-174.51	2.38	51.18	0.029	-32.14	0.620	-147.05
4.8	0.902	-175.11	2.26	49.48	0.029	-33.55	0.632	-147.73
5.0	0.904	-175.68	2.14	47.81	0.028	-34.91	0.643	-148.41
5.2	0.905	-176.23	2.04	46.19	0.028	-36.24	0.654	-149.09
5.4	0.907	-176.76	1.94	44.60	0.027	-37.52	0.665	-149.77
5.6	0.909	-177.28	1.85	43.06	0.027	-38.77	0.675	-150.45
5.8	0.910	-177.79	1.76	41.54	0.027	-39.98	0.685	-151.13
6.0	0.912	-178.29	1.68	40.07	0.026	-41.15	0.695	-151.81
6.2	0.914	-178.77	1.61	38.63	0.026	-42.29	0.704	-152.48
6.4	0.915	-179.25	1.54	37.21	0.025	-43.40	0.713	-153.14
6.6	0.917	-179.72	1.48	35.83	0.025	-44.47	0.722	-153.80
6.8	0.918	-179.82	1.42	34.48	0.024	-45.52	0.730	-154.46
7.0	0.919	-179.36	1.36	33.16	0.024	-46.53	0.738	-155.11
7.2	0.921	-178.91	1.31	31.87	0.024	-47.51	0.745	-155.75
7.4	0.922	-178.46	1.26	30.60	0.023	-48.47	0.753	-156.38
7.6	0.923	-178.02	1.21	29.36	0.023	-49.40	0.760	-157.01
7.8	0.925	-177.58	1.17	28.14	0.022	-50.30	0.767	-157.63
8.0	0.926	-177.15	1.12	26.94	0.022	-51.18	0.773	-158.24

To download the s-parameters in s2p format, go to the [CG2H80015D](#) product page and click on the documentation tab.



**Typical Package S-Parameters for CG2H80015D**  
**(Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 200\text{ mA}$ , magnitude / angle)**

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
0.5	0.914	-119.76	23.66	114.12	0.025	24.92	0.414	-115.65
0.6	0.908	-128.48	20.44	109.01	0.026	19.96	0.414	-123.32
0.7	0.903	-135.16	17.92	104.91	0.026	16.02	0.414	-128.96
0.8	0.900	-140.41	15.92	101.51	0.027	12.78	0.415	-133.20
0.9	0.898	-144.63	14.29	98.61	0.027	10.04	0.417	-136.45
1.0	0.896	-148.09	12.95	96.08	0.027	7.66	0.419	-138.97
1.1	0.895	-150.98	11.83	93.82	0.027	5.56	0.422	-140.95
1.2	0.894	-153.43	10.87	91.77	0.027	3.68	0.425	-142.52
1.3	0.894	-155.54	10.06	89.90	0.027	1.96	0.428	-143.78
1.4	0.893	-157.37	9.35	88.16	0.027	0.38	0.432	-144.79
1.5	0.893	-158.97	8.73	86.52	0.027	-1.09	0.436	-145.61
1.6	0.893	-160.39	8.18	84.98	0.027	-2.47	0.440	-146.29
1.8	0.893	-162.80	7.26	82.12	0.027	-5.02	0.448	-147.30
2.0	0.894	-164.77	6.51	79.48	0.027	-7.34	0.458	-148.00
2.2	0.894	-166.42	5.90	77.01	0.027	-9.49	0.468	-148.51
2.4	0.895	-167.84	5.38	74.67	0.027	-11.51	0.478	-148.89
2.6	0.896	-169.07	4.94	72.45	0.026	-13.41	0.489	-149.21
2.8	0.897	-170.15	4.56	70.31	0.026	-15.23	0.500	-149.49
3.0	0.898	-171.13	4.23	68.25	0.026	-16.97	0.511	-149.76
3.2	0.899	-172.01	3.93	66.25	0.026	-18.64	0.523	-150.03
3.4	0.900	-172.81	3.68	64.32	0.026	-20.24	0.534	-150.30
3.6	0.902	-173.55	3.44	62.44	0.025	-21.80	0.545	-150.59
3.8	0.903	-174.25	3.24	60.62	0.025	-23.30	0.557	-150.90
4.0	0.904	-174.90	3.05	58.83	0.025	-24.75	0.568	-151.23
4.2	0.906	-175.51	2.88	57.09	0.024	-26.16	0.579	-151.57
4.4	0.907	-176.09	2.72	55.40	0.024	-27.53	0.590	-151.94
4.6	0.908	-176.65	2.58	53.74	0.024	-28.86	0.601	-152.33
4.8	0.910	-177.19	2.45	52.11	0.023	-30.15	0.612	-152.73
5.0	0.911	-177.71	2.33	50.53	0.023	-31.40	0.622	-153.15
5.2	0.912	-178.21	2.22	48.97	0.023	-32.62	0.632	-153.59
5.4	0.913	-178.69	2.11	47.45	0.023	-33.81	0.642	-154.03
5.6	0.915	-179.17	2.02	45.96	0.022	-34.96	0.652	-154.49
5.8	0.916	-179.63	1.93	44.50	0.022	-36.08	0.661	-154.96
6.0	0.917	-179.92	1.85	43.07	0.022	-37.17	0.670	-155.43
6.2	0.918	-179.47	1.77	41.67	0.021	-38.22	0.679	-155.92
6.4	0.920	-179.03	1.70	40.29	0.021	-39.25	0.688	-156.41
6.6	0.921	-178.60	1.63	38.94	0.021	-40.25	0.696	-156.90
6.8	0.922	-178.17	1.56	37.62	0.020	-41.22	0.704	-157.39
7.0	0.923	-177.75	1.50	36.32	0.020	-42.17	0.712	-157.89
7.2	0.924	-177.33	1.45	35.04	0.020	-43.09	0.720	-158.39
7.4	0.925	-176.92	1.39	33.79	0.019	-43.98	0.727	-158.90
7.6	0.926	-176.51	1.34	32.56	0.019	-44.85	0.734	-159.40
7.8	0.927	-176.10	1.30	31.35	0.019	-45.69	0.741	-159.90
8.0	0.928	-175.69	1.25	30.16	0.018	-46.51	0.747	-160.40

To download the s-parameters in s2p format, go to the [CG2H80015D](#) product page and click on the documentation tab.



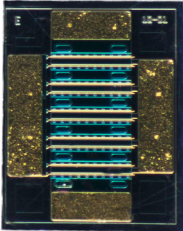
**Typical Package S-Parameters for CG2H80015D**  
**(Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 500\text{ mA}$ , magnitude / angle)**

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
0.5	0.925	-129.48	24.00	109.96	0.020	20.87	0.401	-131.97
0.6	0.920	-137.20	20.52	105.38	0.020	16.47	0.406	-137.90
0.7	0.918	-143.01	17.88	101.74	0.021	13.01	0.411	-142.09
0.8	0.916	-147.53	15.81	98.73	0.021	10.18	0.414	-145.14
0.9	0.914	-151.13	14.15	96.16	0.021	7.79	0.418	-147.40
1.0	0.914	-154.07	12.79	93.91	0.021	5.73	0.421	-149.10
1.1	0.913	-156.52	11.66	91.90	0.021	3.90	0.424	-150.39
1.2	0.913	-158.60	10.71	90.08	0.021	2.26	0.428	-151.38
1.3	0.912	-160.38	9.89	88.39	0.021	0.76	0.431	-152.14
1.4	0.912	-161.93	9.19	86.83	0.021	-0.63	0.435	-152.72
1.5	0.912	-163.29	8.58	85.35	0.021	-1.92	0.439	-153.16
1.6	0.912	-164.49	8.04	83.95	0.021	-3.14	0.443	-153.50
1.8	0.912	-166.54	7.13	81.34	0.021	-5.38	0.451	-153.93
2.0	0.913	-168.23	6.40	78.92	0.021	-7.44	0.459	-154.16
2.2	0.913	-169.65	5.79	76.63	0.021	-9.36	0.468	-154.27
2.4	0.914	-170.87	5.29	74.46	0.021	-11.16	0.478	-154.31
2.6	0.914	-171.94	4.85	72.38	0.021	-12.87	0.488	-154.32
2.8	0.915	-172.89	4.48	70.38	0.020	-14.50	0.498	-154.32
3.0	0.916	-173.74	4.16	68.44	0.020	-16.07	0.508	-154.33
3.2	0.916	-174.52	3.87	66.56	0.020	-17.58	0.519	-154.36
3.4	0.917	-175.24	3.62	64.72	0.020	-19.03	0.529	-154.41
3.6	0.918	-175.91	3.39	62.94	0.020	-20.44	0.540	-154.49
3.8	0.919	-176.53	3.19	61.19	0.019	-21.80	0.550	-154.60
4.0	0.920	-177.12	3.01	59.49	0.019	-23.12	0.561	-154.75
4.2	0.921	-177.68	2.84	57.82	0.019	-24.41	0.571	-154.92
4.4	0.922	-178.21	2.69	56.19	0.019	-25.65	0.582	-155.12
4.6	0.923	-178.72	2.55	54.59	0.018	-26.86	0.592	-155.35
4.8	0.923	-179.21	2.43	53.03	0.018	-28.04	0.602	-155.61
5.0	0.924	-179.69	2.31	51.49	0.018	-29.18	0.612	-155.89
5.2	0.925	-179.85	2.20	49.99	0.018	-30.29	0.622	-156.19
5.4	0.926	-179.40	2.10	48.51	0.018	-31.37	0.631	-156.51
5.6	0.927	-178.96	2.01	47.06	0.017	-32.41	0.640	-156.85
5.8	0.928	-178.53	1.92	45.64	0.017	-33.43	0.649	-157.21
6.0	0.929	-178.10	1.84	44.24	0.017	-34.42	0.658	-157.57
6.2	0.930	-177.69	1.76	42.87	0.017	-35.37	0.667	-157.96
6.4	0.931	-177.28	1.69	41.52	0.016	-36.30	0.675	-158.35
6.6	0.931	-176.87	1.63	40.20	0.016	-37.21	0.683	-158.75
6.8	0.932	-176.47	1.56	38.90	0.016	-38.08	0.691	-159.16
7.0	0.933	-176.07	1.50	37.62	0.015	-38.93	0.699	-159.58
7.2	0.934	-175.68	1.45	36.36	0.015	-39.75	0.707	-160.00
7.4	0.934	-175.29	1.40	35.13	0.015	-40.54	0.714	-160.43
7.6	0.935	-174.90	1.35	33.91	0.015	-41.31	0.721	-160.86
7.8	0.936	-174.51	1.30	32.72	0.014	-42.05	0.728	-161.30
8.0	0.937	-174.13	1.26	31.54	0.014	-42.77	0.734	-161.73

To download the s-parameters in s2p format, go to the [CG2H80015D](#) product page and click on the documentation tab.



### Product Ordering Information

Order Number	Description	Unit of Measure	Image
CG2H80015D	GaN HEMT Bare Die	Each	 A microscopic image of a GaN HEMT bare die, showing a rectangular chip with a central region of blue and green material, surrounded by gold-colored pads and a black substrate.



For more information, please contact:

4600 Silicon Drive  
Durham, North Carolina, USA 27703  
[www.wolfspeed.com/rf](http://www.wolfspeed.com/rf)

Sales Contact  
[rfsales@cree.com](mailto:rfsales@cree.com)

## Notes & Disclaimer

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