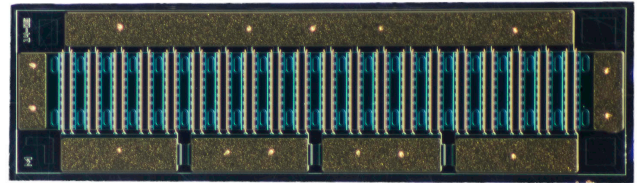


# CG2H80060D

60 W, 8.0 GHz, GaN HEMT Die

## Description

Cree's CG2H80060D 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: CG2H80060D

## Features

- 15 dB Typical Small Signal Gain at 4 GHz
- 12 dB Typical Small Signal Gain at 8 GHz
- 60 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

**RoHS**  
COMPLIANT

Large Signal Models Available for ADS & 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                                 | $I_{GMAX}$      | 15        | mA    | 25 °C      |
| Maximum Drain Current <sup>1</sup>                           | $I_{DMAX}$      | 6         | A     | 25 °C      |
| Thermal Resistance, Junction to Case (packaged) <sup>2</sup> | $R_{\theta JC}$ | 2.8       | °C/W  |            |
| Thermal Resistance, Junction to Case (die only)              | $R_{\theta JC}$ | 1.5       | °C/W  | 85 °C      |
| 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 60 mil thick CuMoCu carrier

### Electrical Characteristics (Frequency = 4 GHz unless otherwise stated; $T_c = 25^\circ\text{C}$ )

| Characteristics                     | Symbol       | Min. | Typ. | Max.   | Units    | Conditions                                                                 |
|-------------------------------------|--------------|------|------|--------|----------|----------------------------------------------------------------------------|
| <b>DC Characteristics</b>           |              |      |      |        |          |                                                                            |
| Gate Threshold Voltage              | $V_{GS(th)}$ | -3.8 | -3.0 | -2.3   | $V_{DC}$ | $V_{DS} = 10\text{ V}, I_D = 14.4\text{ mA}$                               |
| Gate Quiescent Voltage              | $V_{GS(Q)}$  | -    | -2.7 | -      | $V_{DC}$ | $V_{DD} = 28\text{ V}, I_{DQ} = 400\text{ mA}$                             |
| Drain Current                       | $I_{DSS}$    | 11.6 | 14.0 | -      | A        | $V_{DS} = 6.0\text{ V}, V_{GS} = 2.0\text{ V}$                             |
| Drain-Source Breakdown Voltage      | $V_{BD}$     | 120  | -    | -      | V        | $V_{GS} = -8\text{ V}, I_D = 14.4\text{ mA}$                               |
| On Resistance                       | $R_{ON}$     | -    | 0.17 | -      | $\Omega$ | $V_{DS} = 0.10\text{ V}$                                                   |
| Gate Forward Voltage                | $V_{G-ON}$   | -    | 1.9  | -      | V        | $I_{GS} = 14.4\text{ mA}$                                                  |
| <b>RF Characteristics</b>           |              |      |      |        |          |                                                                            |
| Small Signal Gain                   | $G_{SS}$     | -    | 15   | -      | dB       | $V_{DD} = 28\text{ V}, I_{DQ} = 400\text{ mA}$                             |
| Saturated Output Power <sup>1</sup> | $P_{SAT}$    | -    | 60   | -      | W        | $V_{DD} = 28\text{ V}, I_{DQ} = 400\text{ mA}$                             |
| Drain Efficiency <sup>2</sup>       | $\eta$       | -    | 65   | -      | %        | $V_{DD} = 28\text{ V}, I_{DQ} = 400\text{ mA}, P_{SAT} = 60\text{ W}$      |
| Intermodulation Distortion          | IM3          | -    | -30  | -      | dBc      | $V_{DD} = 28\text{ V}, I_{DQ} = 400\text{ mA}, P_{OUT} = 60\text{ W PEP}$  |
| Output Mismatch Stress <sup>3</sup> | VSWR         | -    | -    | 10 : 1 | $\Psi$   | $V_{DD} = 28\text{ V}, I_{DQ} = 400\text{ mA}, P_{OUT} = 60\text{ W (CW)}$ |
| <b>Dynamic Characteristics</b>      |              |      |      |        |          |                                                                            |
| Input Capacitance                   | $C_{GS}$     | -    | 14.7 | -      | pF       | $V_{DS} = 28\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$             |
| Output Capacitance                  | $C_{DS}$     | -    | 4.4  | -      | pF       | $V_{DS} = 28\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$             |
| Feedback Capacitance                | $C_{GD}$     | -    | 0.8  | -      | pF       | $V_{DS} = 28\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$             |

Notes:

<sup>1</sup>  $P_{SAT}$  is defined as  $I_G = 0.7\text{ mA}$

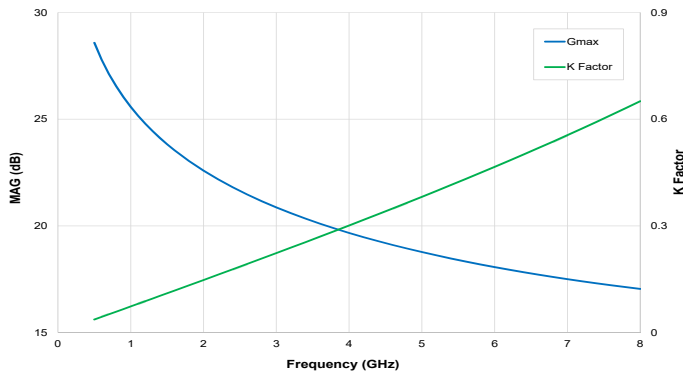
<sup>2</sup> Drain Efficiency =  $P_{OUT} / P_{DC}$

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

## Typical Performance

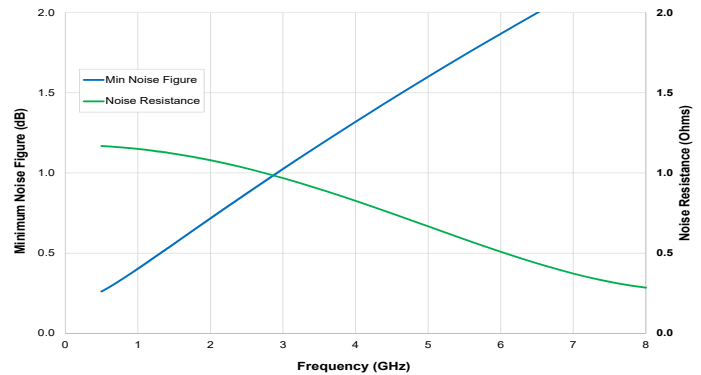
### Simulated Maximum Available Gain and K Factor

$$V_{DD} = 28 \text{ V}, I_{DQ} = 400 \text{ mA}$$



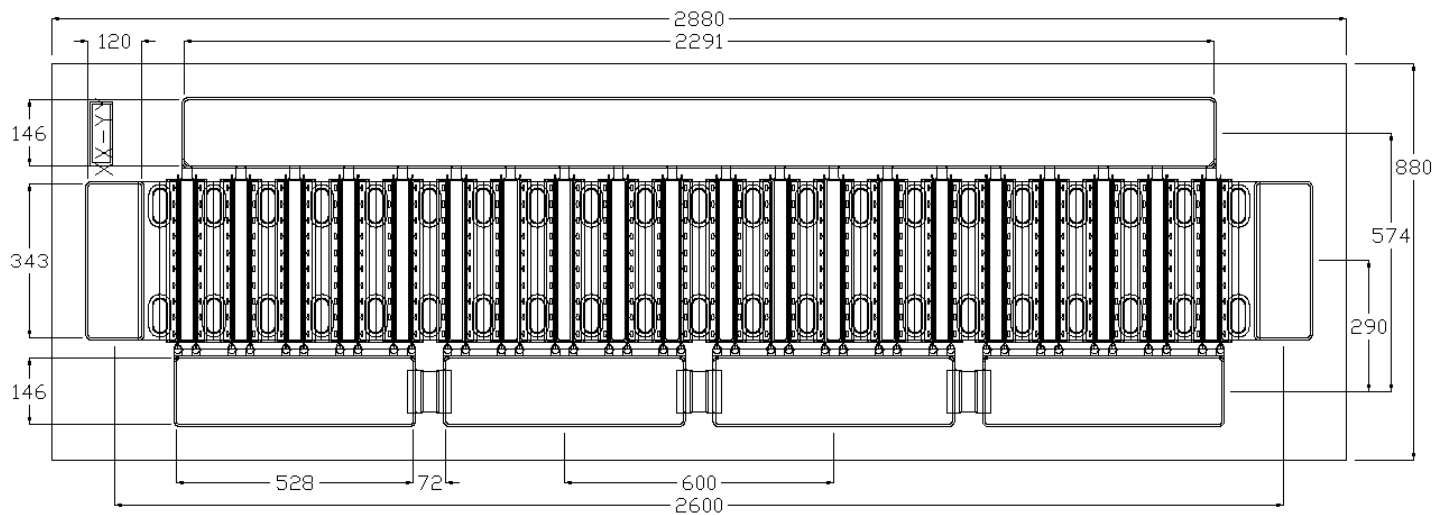
### Simulated Minimum Noise Figure and Noise Resistance vs. Frequency

$$V_{DD} = 28 \text{ V}, I_{DQ} = 400 \text{ mA}$$



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

## Die Dimensions (units in microns)



Overall die size 2880 x 880 (+0/-50) microns, die thickness 100 (+/- 10) microns.  
All Gate and Drain pads must be wire bonded for electrical connection

## 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 CG2H80060D**  
**(Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 400\text{ mA}$ , magnitude / angle)**

| Frequency | Mag S11 | Ang S11 | Mag S21 | Ang S21 | Mag S12 | Ang S12 | Mag S22 | Ang S22 |
|-----------|---------|---------|---------|---------|---------|---------|---------|---------|
| 0.5       | 0.940   | -168.07 | 9.42    | 88.99   | 0.013   | -0.29   | 0.735   | -172.83 |
| 0.6       | 0.940   | -169.98 | 7.85    | 86.72   | 0.013   | -2.42   | 0.738   | -173.30 |
| 0.7       | 0.941   | -171.35 | 6.71    | 84.72   | 0.013   | -4.27   | 0.740   | -173.54 |
| 0.8       | 0.941   | -172.36 | 5.86    | 82.90   | 0.013   | -5.95   | 0.743   | -173.64 |
| 0.9       | 0.941   | -173.15 | 5.19    | 81.20   | 0.013   | -7.51   | 0.745   | -173.64 |
| 1.0       | 0.942   | -173.77 | 4.66    | 79.58   | 0.013   | -8.98   | 0.748   | -173.59 |
| 1.1       | 0.942   | -174.28 | 4.21    | 78.04   | 0.013   | -10.38  | 0.750   | -173.50 |
| 1.2       | 0.942   | -174.70 | 3.85    | 76.54   | 0.013   | -11.73  | 0.753   | -173.38 |
| 1.3       | 0.943   | -175.06 | 3.53    | 75.10   | 0.013   | -13.03  | 0.756   | -173.25 |
| 1.4       | 0.944   | -175.36 | 3.26    | 73.69   | 0.013   | -14.30  | 0.759   | -173.10 |
| 1.5       | 0.944   | -175.62 | 3.03    | 72.31   | 0.013   | -15.53  | 0.763   | -172.96 |
| 1.6       | 0.945   | -175.85 | 2.82    | 70.97   | 0.012   | -16.73  | 0.766   | -172.81 |
| 1.8       | 0.946   | -176.24 | 2.48    | 68.37   | 0.012   | -19.04  | 0.773   | -172.53 |
| 2.0       | 0.947   | -176.55 | 2.20    | 65.86   | 0.012   | -21.26  | 0.781   | -172.28 |
| 2.2       | 0.949   | -176.81 | 1.97    | 63.45   | 0.012   | -23.38  | 0.788   | -172.05 |
| 2.4       | 0.950   | -177.03 | 1.78    | 61.12   | 0.012   | -25.42  | 0.796   | -171.87 |
| 2.6       | 0.952   | -177.23 | 1.61    | 58.88   | 0.011   | -27.37  | 0.803   | -171.72 |
| 2.8       | 0.953   | -177.41 | 1.47    | 56.72   | 0.011   | -29.24  | 0.811   | -171.61 |
| 3.0       | 0.955   | -177.57 | 1.35    | 54.64   | 0.011   | -31.03  | 0.819   | -171.54 |
| 3.2       | 0.956   | -177.73 | 1.24    | 52.63   | 0.011   | -32.75  | 0.826   | -171.50 |
| 3.4       | 0.958   | -177.87 | 1.15    | 50.70   | 0.011   | -34.39  | 0.833   | -171.49 |
| 3.6       | 0.959   | -178.02 | 1.06    | 48.84   | 0.010   | -35.96  | 0.840   | -171.51 |
| 3.8       | 0.960   | -178.15 | 0.99    | 47.04   | 0.010   | -37.46  | 0.847   | -171.55 |
| 4.0       | 0.962   | -178.28 | 0.92    | 45.32   | 0.010   | -38.90  | 0.854   | -171.61 |
| 4.2       | 0.963   | -178.41 | 0.86    | 43.65   | 0.010   | -40.27  | 0.860   | -171.69 |
| 4.4       | 0.964   | -178.54 | 0.80    | 42.05   | 0.009   | -41.58  | 0.866   | -171.78 |
| 4.6       | 0.965   | -178.67 | 0.75    | 40.50   | 0.009   | -42.83  | 0.871   | -171.89 |
| 4.8       | 0.967   | -178.79 | 0.71    | 39.01   | 0.009   | -44.02  | 0.877   | -172.01 |
| 5.0       | 0.968   | -178.91 | 0.67    | 37.57   | 0.009   | -45.16  | 0.882   | -172.14 |
| 5.2       | 0.969   | -179.03 | 0.63    | 36.18   | 0.009   | -46.25  | 0.887   | -172.27 |
| 5.4       | 0.970   | -179.15 | 0.60    | 34.85   | 0.008   | -47.29  | 0.892   | -172.42 |
| 5.6       | 0.970   | -179.27 | 0.56    | 33.55   | 0.008   | -48.29  | 0.896   | -172.57 |
| 5.8       | 0.971   | -179.39 | 0.53    | 32.30   | 0.008   | -49.23  | 0.900   | -172.72 |
| 6.0       | 0.972   | -179.51 | 0.51    | 31.10   | 0.008   | -50.14  | 0.904   | -172.87 |
| 6.2       | 0.973   | -179.62 | 0.48    | 29.93   | 0.008   | -51.00  | 0.908   | -173.03 |
| 6.4       | 0.974   | -179.74 | 0.46    | 28.80   | 0.008   | -51.83  | 0.911   | -173.19 |
| 6.6       | 0.974   | -179.85 | 0.44    | 27.70   | 0.007   | -52.62  | 0.915   | -173.35 |
| 6.8       | 0.975   | -179.96 | 0.42    | 26.64   | 0.007   | -53.37  | 0.918   | -173.51 |
| 7.0       | 0.976   | -179.92 | 0.40    | 25.62   | 0.007   | -54.09  | 0.921   | -173.67 |
| 7.2       | 0.976   | -179.81 | 0.38    | 24.62   | 0.007   | -54.78  | 0.924   | -173.83 |
| 7.4       | 0.977   | -179.70 | 0.36    | 23.65   | 0.007   | -55.44  | 0.927   | -173.98 |
| 7.6       | 0.977   | -179.59 | 0.35    | 22.71   | 0.007   | -56.06  | 0.929   | -174.14 |
| 7.8       | 0.978   | -179.48 | 0.33    | 21.80   | 0.006   | -56.66  | 0.932   | -174.30 |
| 8.0       | 0.978   | -179.37 | 0.32    | 20.91   | 0.006   | -57.23  | 0.934   | -174.45 |

To download the s-parameters in s2p format, go to the [CG2H80060D](#) product page and click on the documentation tab.



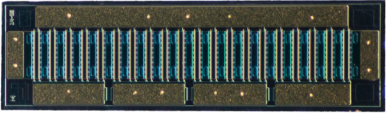
**Typical Package S-Parameters for CG2H80060D**  
**(Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ , magnitude / angle)**

| Frequency | Mag S11 | Ang S11 | Mag S21 | Ang S21 | Mag S12 | Ang S12 | Mag S22 | Ang S22 |
|-----------|---------|---------|---------|---------|---------|---------|---------|---------|
| 0.5       | 0.954   | -169.58 | 9.41    | 89.35   | 0.010   | 0.14    | 0.772   | -175.06 |
| 0.6       | 0.954   | -171.29 | 7.84    | 87.37   | 0.010   | -1.67   | 0.774   | -175.40 |
| 0.7       | 0.954   | -172.52 | 6.71    | 85.64   | 0.010   | -3.25   | 0.775   | -175.57 |
| 0.8       | 0.954   | -173.44 | 5.86    | 84.06   | 0.010   | -4.67   | 0.777   | -175.64 |
| 0.9       | 0.954   | -174.15 | 5.20    | 82.58   | 0.010   | -5.99   | 0.778   | -175.64 |
| 1.0       | 0.955   | -174.73 | 4.67    | 81.19   | 0.010   | -7.23   | 0.780   | -175.60 |
| 1.1       | 0.955   | -175.19 | 4.23    | 79.84   | 0.010   | -8.41   | 0.782   | -175.53 |
| 1.2       | 0.955   | -175.58 | 3.86    | 78.55   | 0.010   | -9.55   | 0.783   | -175.44 |
| 1.3       | 0.955   | -175.92 | 3.55    | 77.29   | 0.010   | -10.65  | 0.785   | -175.34 |
| 1.4       | 0.956   | -176.20 | 3.29    | 76.06   | 0.010   | -11.72  | 0.787   | -175.23 |
| 1.5       | 0.956   | -176.45 | 3.06    | 74.86   | 0.009   | -12.76  | 0.789   | -175.11 |
| 1.6       | 0.956   | -176.66 | 2.85    | 73.68   | 0.009   | -13.78  | 0.791   | -174.99 |
| 1.8       | 0.957   | -177.03 | 2.51    | 71.38   | 0.009   | -15.75  | 0.796   | -174.75 |
| 2.0       | 0.958   | -177.32 | 2.24    | 69.16   | 0.009   | -17.65  | 0.801   | -174.51 |
| 2.2       | 0.959   | -177.57 | 2.01    | 67.01   | 0.009   | -19.49  | 0.806   | -174.30 |
| 2.4       | 0.959   | -177.79 | 1.82    | 64.92   | 0.009   | -21.25  | 0.811   | -174.10 |
| 2.6       | 0.960   | -177.98 | 1.66    | 62.89   | 0.009   | -22.96  | 0.816   | -173.93 |
| 2.8       | 0.961   | -178.15 | 1.53    | 60.91   | 0.009   | -24.61  | 0.822   | -173.78 |
| 3.0       | 0.962   | -178.30 | 1.40    | 59.00   | 0.009   | -26.21  | 0.827   | -173.66 |
| 3.2       | 0.963   | -178.44 | 1.30    | 57.14   | 0.008   | -27.75  | 0.832   | -173.56 |
| 3.4       | 0.964   | -178.58 | 1.20    | 55.33   | 0.008   | -29.23  | 0.838   | -173.48 |
| 3.6       | 0.965   | -178.71 | 1.12    | 53.57   | 0.008   | -30.66  | 0.843   | -173.43 |
| 3.8       | 0.966   | -178.83 | 1.05    | 51.87   | 0.008   | -32.03  | 0.848   | -173.40 |
| 4.0       | 0.967   | -178.95 | 0.98    | 50.22   | 0.008   | -33.36  | 0.854   | -173.38 |
| 4.2       | 0.967   | -179.06 | 0.92    | 48.61   | 0.008   | -34.63  | 0.859   | -173.38 |
| 4.4       | 0.968   | -179.17 | 0.86    | 47.06   | 0.008   | -35.86  | 0.863   | -173.40 |
| 4.6       | 0.969   | -179.28 | 0.81    | 45.55   | 0.007   | -37.04  | 0.868   | -173.43 |
| 4.8       | 0.970   | -179.39 | 0.77    | 44.08   | 0.007   | -38.17  | 0.873   | -173.47 |
| 5.0       | 0.971   | -179.50 | 0.72    | 42.66   | 0.007   | -39.25  | 0.877   | -173.53 |
| 5.2       | 0.971   | -179.61 | 0.69    | 41.28   | 0.007   | -40.30  | 0.881   | -173.60 |
| 5.4       | 0.972   | -179.71 | 0.65    | 39.95   | 0.007   | -41.30  | 0.886   | -173.67 |
| 5.6       | 0.973   | -179.82 | 0.62    | 38.65   | 0.007   | -42.25  | 0.890   | -173.75 |
| 5.8       | 0.973   | -179.92 | 0.59    | 37.39   | 0.007   | -43.17  | 0.893   | -173.84 |
| 6.0       | 0.974   | -179.98 | 0.56    | 36.16   | 0.006   | -44.05  | 0.897   | -173.94 |
| 6.2       | 0.975   | -179.87 | 0.53    | 34.97   | 0.006   | -44.90  | 0.901   | -174.04 |
| 6.4       | 0.975   | -179.77 | 0.51    | 33.82   | 0.006   | -45.70  | 0.904   | -174.14 |
| 6.6       | 0.976   | -179.67 | 0.48    | 32.70   | 0.006   | -46.48  | 0.907   | -174.25 |
| 6.8       | 0.976   | -179.57 | 0.46    | 31.60   | 0.006   | -47.21  | 0.910   | -174.36 |
| 7.0       | 0.977   | -179.47 | 0.44    | 30.54   | 0.006   | -47.92  | 0.913   | -174.48 |
| 7.2       | 0.977   | -179.37 | 0.43    | 29.51   | 0.006   | -48.60  | 0.916   | -174.59 |
| 7.4       | 0.978   | -179.27 | 0.41    | 28.50   | 0.006   | -49.24  | 0.919   | -174.71 |
| 7.6       | 0.978   | -179.17 | 0.39    | 27.52   | 0.006   | -49.86  | 0.921   | -174.83 |
| 7.8       | 0.979   | -179.07 | 0.38    | 26.57   | 0.005   | -50.45  | 0.924   | -174.95 |
| 8.0       | 0.979   | -178.97 | 0.36    | 25.64   | 0.005   | -51.01  | 0.926   | -175.07 |

To download the s-parameters in s2p format, go to the [CG2H80060D](#) product page and click on the documentation tab.



Product Ordering Information

| Order Number | Description       | Unit of Measure | Image                                                                               |
|--------------|-------------------|-----------------|-------------------------------------------------------------------------------------|
| CG2H80060D   | GaN HEMT Bare Die | Each            |  |



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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