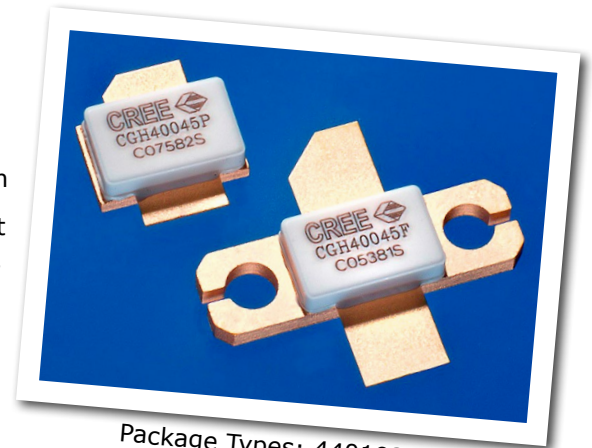


# CGH40045

## 45 W, RF Power GaN HEMT

Cree's CGH40045 is an unmatched, gallium nitride (GaN) high electron mobility transistor (HEMT). The CGH40045, 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 CGH40045 ideal for linear and compressed amplifier circuits. The transistor is available in a flange and pill package.



Package Types: 440193 & 440206  
PN's: CGH40045F & CGH40045P

### FEATURES

- Up to 4 GHz Operation
- 16 dB Small Signal Gain at 2.0 GHz
- 12 dB Small Signal Gain at 4.0 GHz
- 55 W Typical  $P_{SAT}$
- 55 % 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                              | $V_{DS}$   | 84        | 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       |
| Soldering Temperature <sup>2</sup>                | $T_S$      | 245       | °C    |            |
| Screw Torque                                      | $\tau$     | 80        | in-oz |            |
| Thermal Resistance, Junction to Case <sup>3</sup> | $R_{JC}$   | 2.8       | °C/W  | 85°C       |
| Case Operating Temperature <sup>3,4</sup>         | $T_C$      | -40, +150 | °C    | 30 seconds |

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/products/wireless\\_appnotes.asp](http://www.cree.com/products/wireless_appnotes.asp)

<sup>3</sup> Measured for the CGH40045F at  $P_{DISS} = 56W$ .

<sup>4</sup> See also, the Power Dissipation De-rating Curve on Page 8.

## Electrical Characteristics ( $T_C = 25^\circ C$ )

| 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   | $V_{DC}$ | $V_{DS} = 10 V, I_D = 14.4 mA$                                                             |
| Gate Quiescent Voltage                                                                                      | $V_{GS(Q)}$  | -    | -2.7 | -      | $V_{DC}$ | $V_{DS} = 28 V, I_D = 400 mA$                                                              |
| Saturated Drain Current <sup>2</sup>                                                                        | $I_{DS}$     | 11.6 | 14.0 | -      | A        | $V_{DS} = 6.0 V, V_{GS} = 2.0 V$                                                           |
| Drain-Source Breakdown Voltage                                                                              | $V_{BR}$     | 120  | -    | -      | $V_{DC}$ | $V_{GS} = -8 V, I_D = 14.4 mA$                                                             |
| <b>RF Characteristics<sup>3</sup> (<math>T_C = 25^\circ C, F_0 = 2.5 GHz</math> unless otherwise noted)</b> |              |      |      |        |          |                                                                                            |
| Small Signal Gain                                                                                           | $G_{SS}$     | 12.5 | 14   | -      | dB       | $V_{DD} = 28 V, I_{DQ} = 400 mA$                                                           |
| Power Output <sup>4</sup>                                                                                   | $P_{SAT}$    | 40   | 55   | -      | W        | $V_{DD} = 28 V, I_{DQ} = 400 mA$                                                           |
| Drain Efficiency <sup>5</sup>                                                                               | $\eta$       | 45   | 55   | -      | %        | $V_{DD} = 28 V, I_{DQ} = 400 mA, P_{OUT} = P_{SAT}$                                        |
| Output Mismatch Stress                                                                                      | VSWR         | -    | -    | 10 : 1 | $\Psi$   | No damage at all phase angles,<br>$V_{DD} = 28 V, I_{DQ} = 400 mA,$<br>$P_{OUT} = 45 W CW$ |
| <b>Dynamic Characteristics</b>                                                                              |              |      |      |        |          |                                                                                            |
| Input Capacitance                                                                                           | $C_{GS}$     | -    | 19.0 | -      | pF       | $V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz$                                                  |
| Output Capacitance                                                                                          | $C_{DS}$     | -    | 5.9  | -      | pF       | $V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz$                                                  |
| Feedback Capacitance                                                                                        | $C_{GD}$     | -    | 0.8  | -      | pF       | $V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz$                                                  |

Notes:

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

<sup>2</sup> Scaled from PCM data.

<sup>3</sup> Measured in CGH40045F-TB.

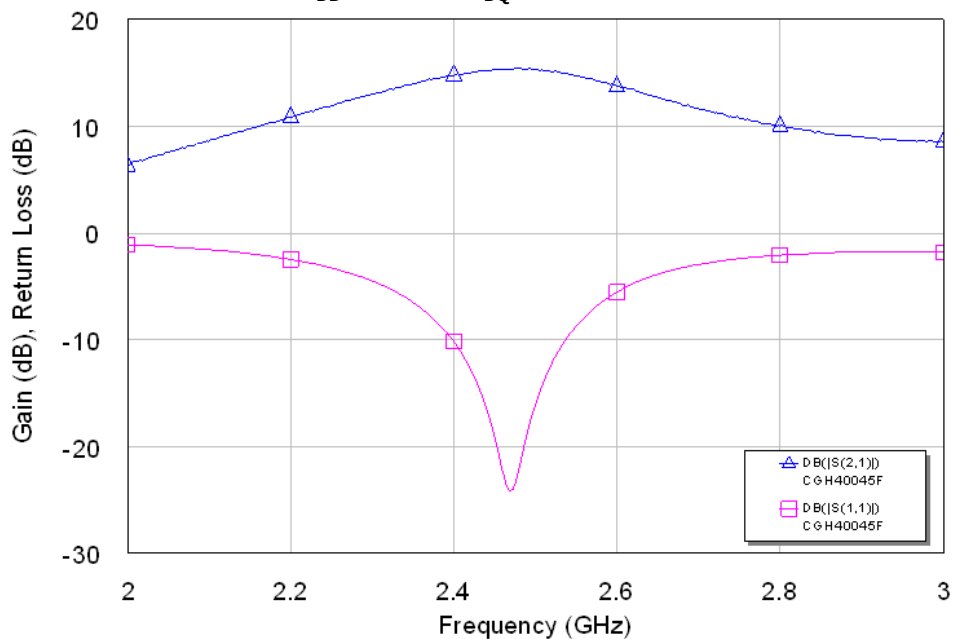
<sup>4</sup>  $P_{SAT}$  is defined as  $I_G = 1.08 mA$ .

<sup>5</sup> Drain Efficiency =  $P_{OUT} / P_{DC}$

## Typical Performance

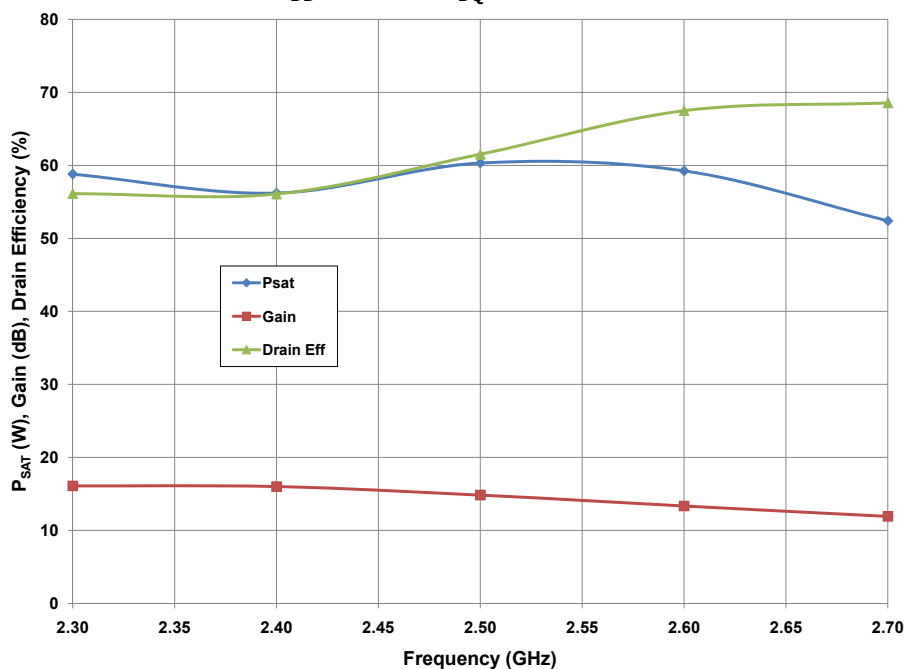
### Simulated Small Signal Gain and Input Return Loss of the CGH40045-TB vs Frequency

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



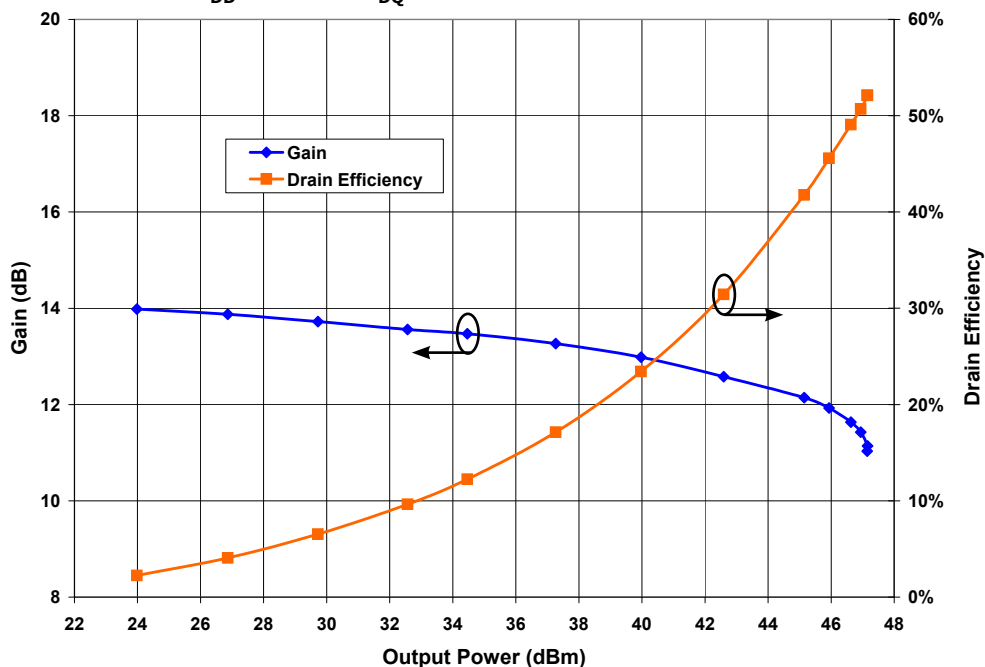
### Gain, Efficiency, and Output Power vs Frequency of the CGH40045F measured in Amplifier Circuit CGH40045-TB

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

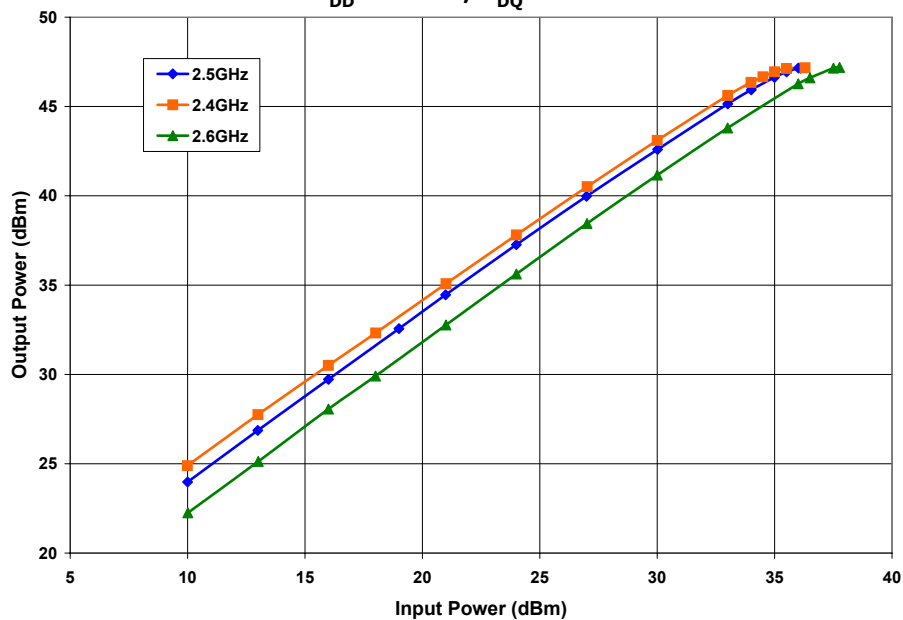


## Typical Performance

**Gain and Efficiency vs Output Power of the  
CGH40045 measured in Amplifier Circuit CGH40045F-TB**  
 $V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 400\text{ mA}$ , Freq = 2.5 GHz

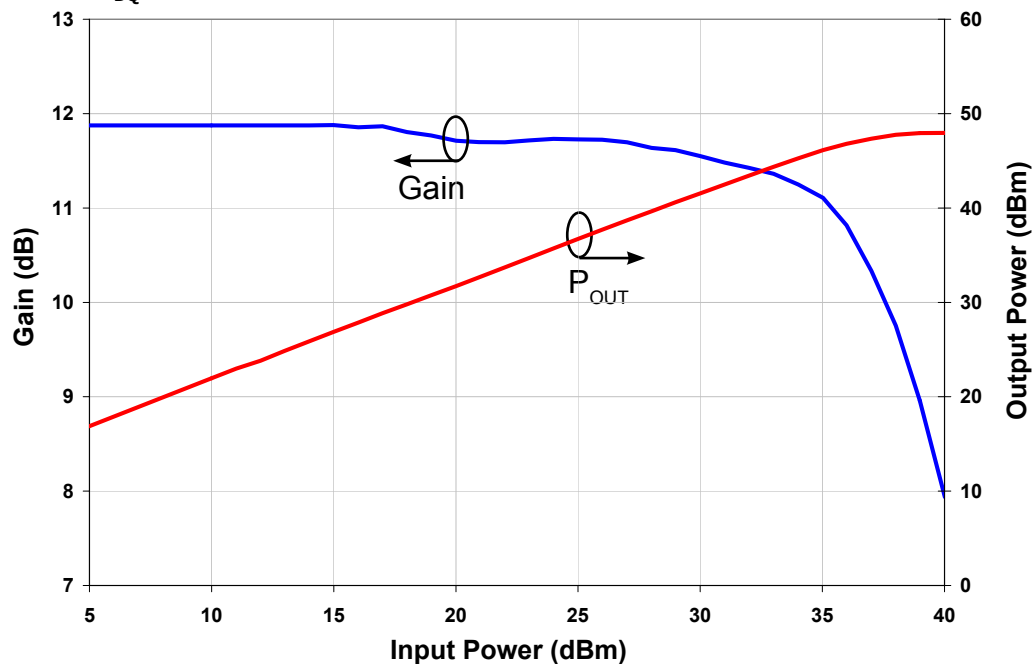


**Single Tone CW Output Power vs Input Power of  
the CGH40045 measured in Amplifier Circuit CGH40045F-TB**  
 $V_{DD} = 28\text{ V}$ ,  $I_{DQ} = 400\text{ mA}$

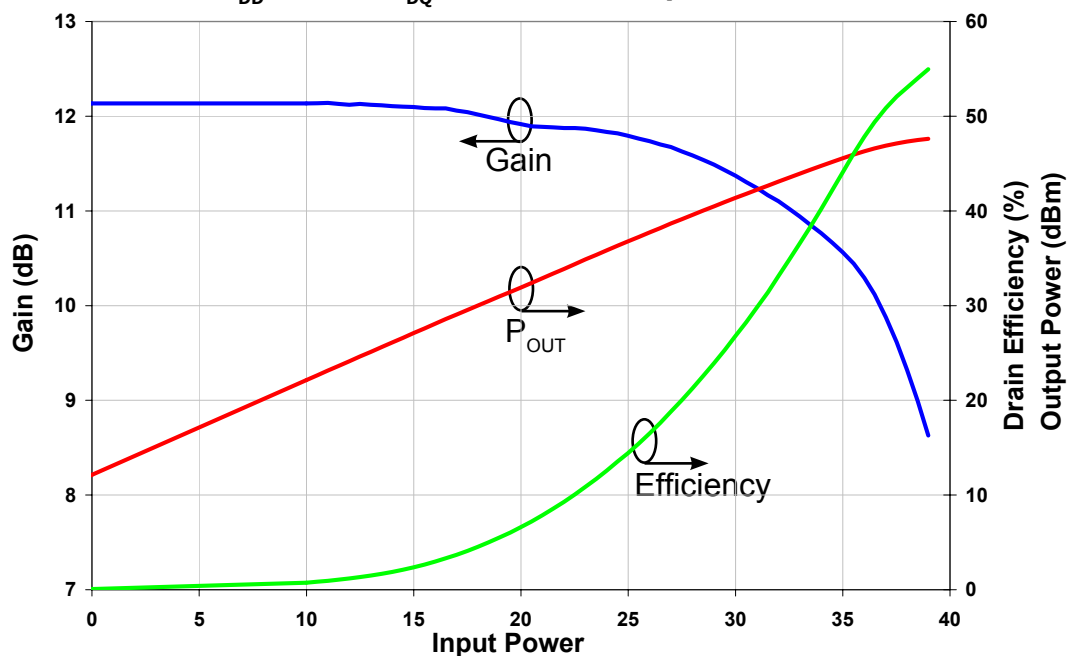


## Typical Performance

**Pulsed Gain and Output Power vs Input Power of the CGH40045 measured in an Amplifier Circuit**  
 $V_{DD} = 28 \text{ V}$ ,  $I_{DQ} = 800 \text{ mA}$ , Freq = 3.6 GHz, Pulse Width=200 $\mu$ S, 10% Duty Cycle



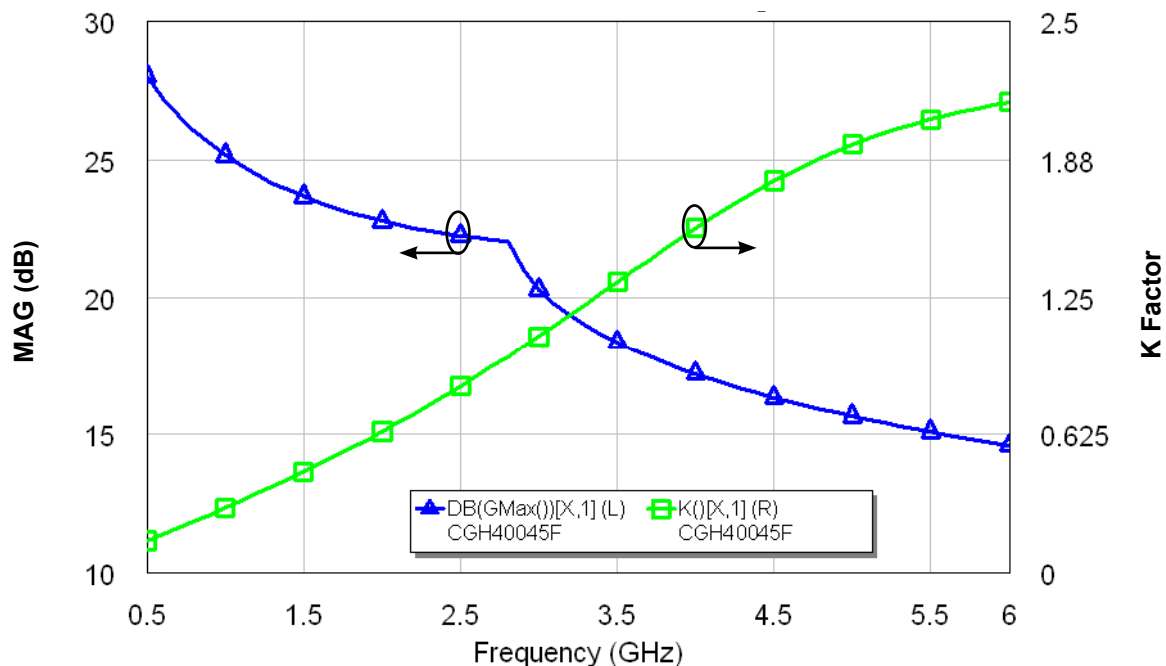
**Single Tone CW Gain, Efficiency, and Output Power vs Input Power of the CGH40045 measured in an Amplifier Circuit**  
 $V_{DD} = 28 \text{ V}$ ,  $I_{DQ} = 800 \text{ mA}$ , Freq = 3.6 GHz



## Typical Performance

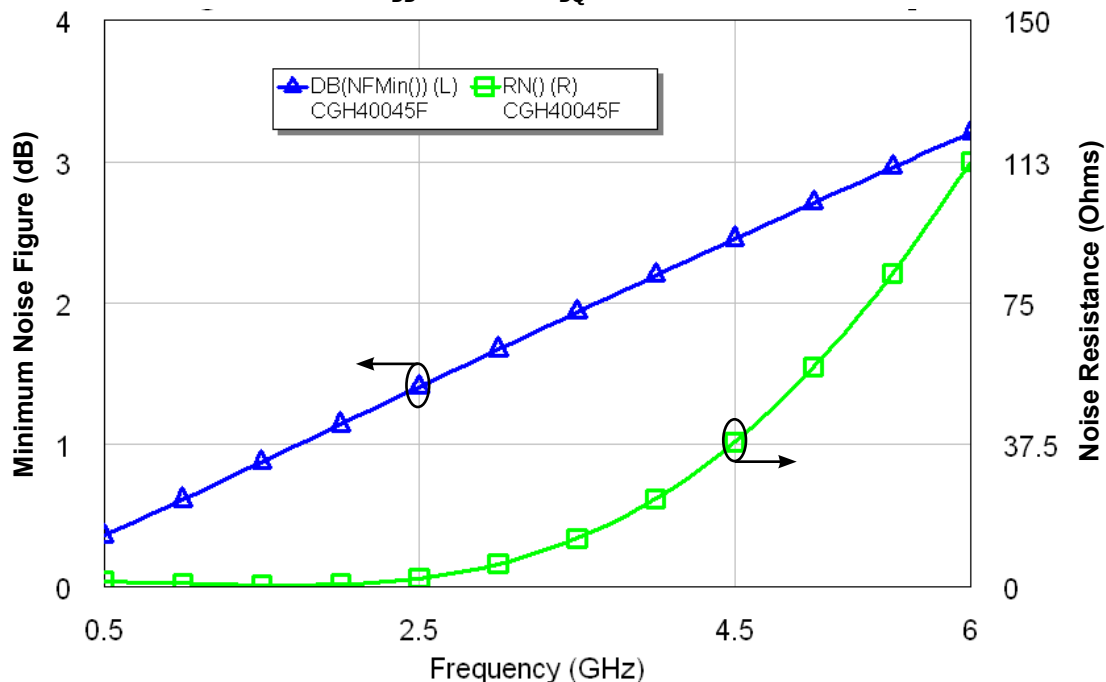
### Simulated Maximum Available Gain and K Factor of the CGH40045

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



## Typical Noise Performance

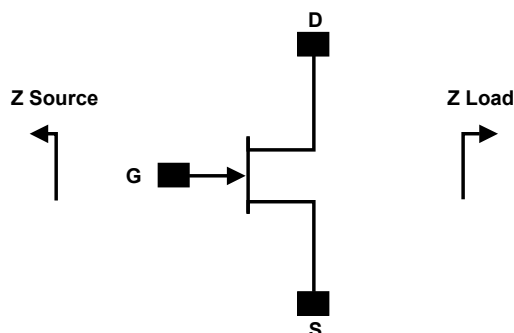
**Simulated Minimum Noise Figure and Noise Resistance vs Frequency of the CGH40045**  
 $V_{DD} = 28 \text{ V}$ ,  $I_{DQ} = 400 \text{ mA}$



## 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 |

## Simulated Source and Load Impedances



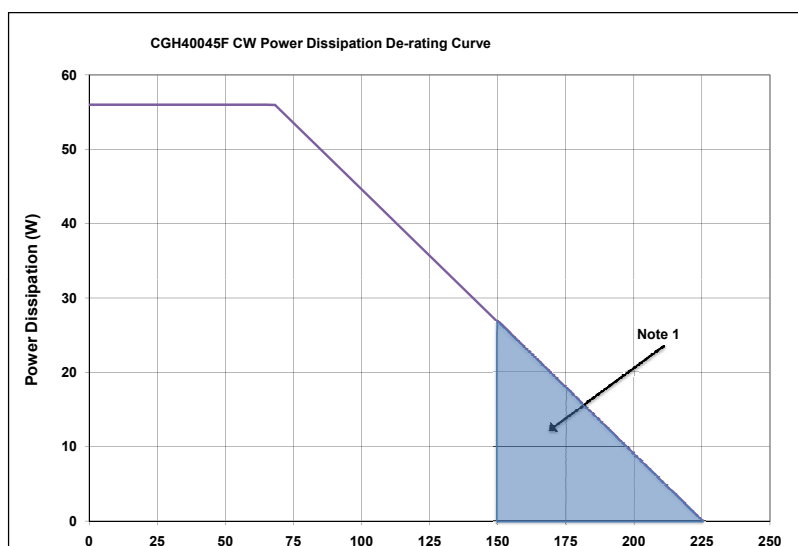
| Frequency (MHz) | Z Source       | Z Load          |
|-----------------|----------------|-----------------|
| 500             | $4.1 + j5.27$  | $14.73 + j6.91$ |
| 750             | $2.9 + j 4.1$  | $12.3 + j 7.6$  |
| 1000            | $2.48 + j0.06$ | $8.13 + j6.85$  |
| 1100            | $1.9 + j 3.1$  | $9.2 + j 6.2$   |
| 1500            | $2.1 - j 2.5$  | $6.0 + j 4.3$   |
| 1800            | $2.1 - j 1.9$  | $5.8 + j 4.1$   |
| 2000            | $0.69 - j3.75$ | $4.93 + j0.16$  |
| 2100            | $1.5 - j 4.4$  | $5.1 + j 2.8$   |
| 3000            | $1.06 - j8.92$ | $4.04 - j2.98$  |
| 4000            | $1.67 - j18.1$ | $4.97 - j8.25$  |

Note 1.  $V_{DD} = 28V$ ,  $I_{DQ} = 800mA$  in the 440193 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.

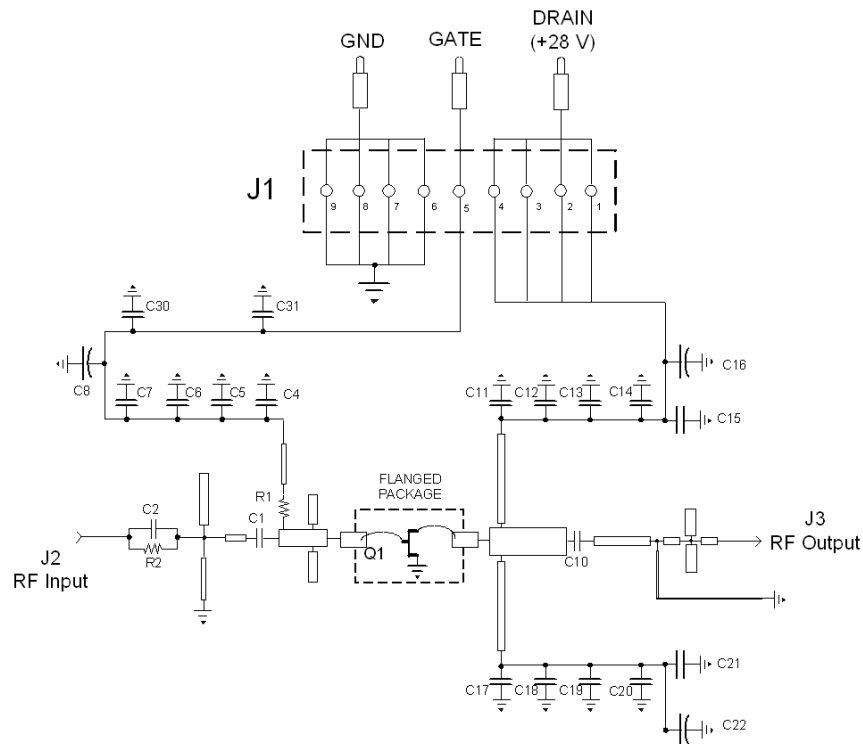
## CGH40045 Power Dissipation De-rating Curve



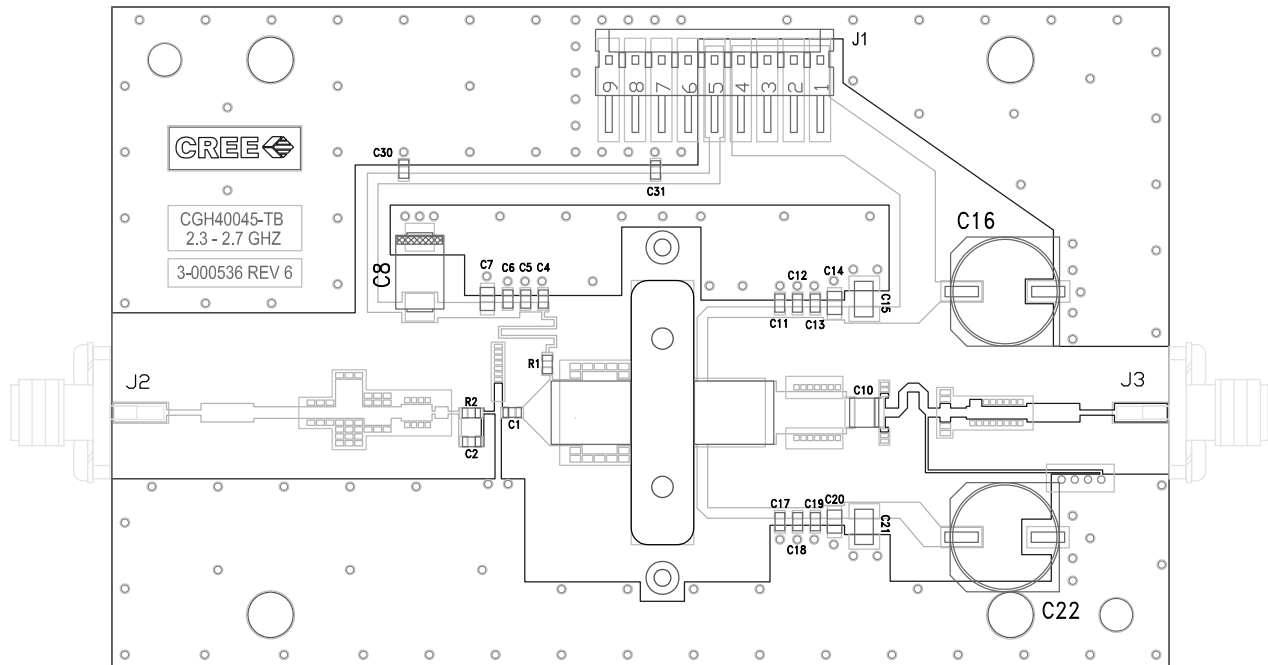
Note 1. Area exceeds Maximum Case Operating Temperature (See Page 2).



## CGH40045-TB Demonstration Amplifier Circuit Schematic



## CGH40045-TB Demonstration Amplifier Circuit Outline

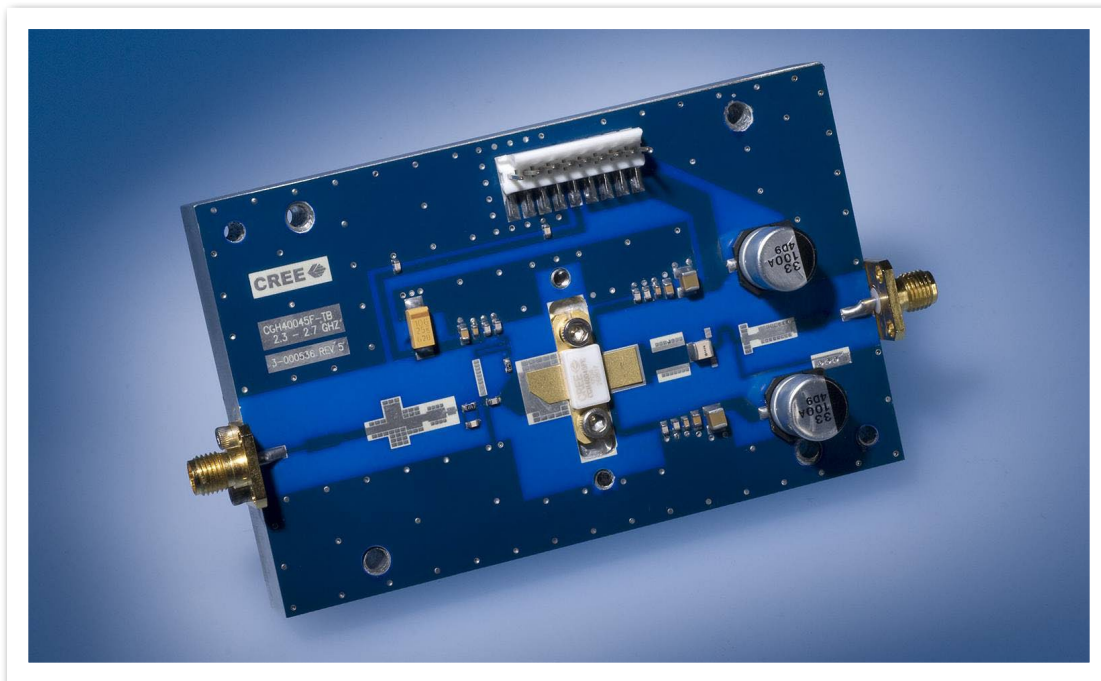


Note: The device slot is machined to different depths to support either pill or flanged versions

## CGH40045-TB Demonstration Amplifier Circuit Bill of Materials

| Designator         | Description                             | Qty |
|--------------------|-----------------------------------------|-----|
| C1                 | CAP, 0.8pF, $\pm 0.1$ pF, 0603          | 1   |
| C2                 | CAP, 2.2pF, $\pm 0.1$ pF, 0603          | 1   |
| C4,C11,C17         | CAP, 10.0pF, $\pm 5\%$ , 0603, ATC      | 3   |
| C6,C13, C19        | CAP, 470pF $\pm 5\%$ , 100 V, 0603, X7R | 3   |
| C7,C14,C20         | CAP,33000PF, 0805,100V, X7R             | 3   |
| C8                 | CAP, 10UF, 16V, SMT, TANTALUM           | 1   |
| C10                | CAP, 8.2pF $\pm 5\%$ , ATC100B          | 1   |
| C15,C21            | CAP, 1.0UF $\pm 10\%$ , 100V, 1210, X7R | 2   |
| C5,C12,C18,C30,C31 | CAP, 82.0pF, $\pm 5\%$ , 0603           | 5   |
| C16,C22            | CAP, 33UF, 20%, G CASE                  | 2   |
| R2                 | RES, 1/16W, 0603, 100 Ohms 1%           | 1   |
| R1                 | RES, 1/16W, 0603, 5.1 Ohms 1%           | 1   |
| J2,J3              | CONN, SMA, PANEL MOUNT JACK, FLANGE     | 2   |
| J1                 | CONN, HEADER, RT>PLZ .1CEN LK 9POS      | 1   |
| -                  | PCB, RO4350B, Er = 3.48, h = 20 mil     | 1   |
| Q1                 | CGH40045                                | 1   |

## CGH40045-TB Demonstration Amplifier Circuit





## Typical Package S-Parameters for CGH40045 (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 |
|-----------|---------|---------|---------|---------|---------|---------|---------|---------|
| 500 MHz   | 0.941   | -171.75 | 7.34    | 80.91   | 0.012   | -3.58   | 0.650   | -173.39 |
| 600 MHz   | 0.941   | -174.07 | 6.12    | 77.22   | 0.012   | -6.14   | 0.655   | -173.73 |
| 700 MHz   | 0.941   | -175.88 | 5.24    | 73.81   | 0.012   | -8.41   | 0.660   | -173.93 |
| 800 MHz   | 0.942   | -177.39 | 4.59    | 70.58   | 0.012   | -10.49  | 0.665   | -174.05 |
| 900 MHz   | 0.942   | -178.70 | 4.07    | 67.49   | 0.012   | -12.42  | 0.671   | -174.15 |
| 1.0 GHz   | 0.942   | -179.88 | 3.66    | 64.51   | 0.011   | -14.23  | 0.677   | -174.24 |
| 1.1 GHz   | 0.943   | 179.05  | 3.33    | 61.61   | 0.011   | -15.93  | 0.683   | -174.35 |
| 1.2 GHz   | 0.943   | 178.03  | 3.05    | 58.78   | 0.011   | -17.54  | 0.689   | -174.49 |
| 1.3 GHz   | 0.944   | 177.07  | 2.82    | 56.03   | 0.011   | -19.06  | 0.695   | -174.66 |
| 1.4 GHz   | 0.944   | 176.13  | 2.62    | 53.33   | 0.011   | -20.50  | 0.701   | -174.86 |
| 1.5 GHz   | 0.945   | 175.21  | 2.45    | 50.69   | 0.011   | -21.86  | 0.707   | -175.10 |
| 1.6 GHz   | 0.945   | 174.30  | 2.30    | 48.10   | 0.011   | -23.14  | 0.713   | -175.37 |
| 1.7 GHz   | 0.945   | 173.40  | 2.17    | 45.56   | 0.011   | -24.34  | 0.718   | -175.68 |
| 1.8 GHz   | 0.946   | 172.49  | 2.06    | 43.05   | 0.010   | -25.47  | 0.724   | -176.02 |
| 1.9 GHz   | 0.946   | 171.58  | 1.96    | 40.59   | 0.010   | -26.53  | 0.729   | -176.40 |
| 2.0 GHz   | 0.946   | 170.65  | 1.87    | 38.16   | 0.010   | -27.51  | 0.734   | -176.81 |
| 2.1 GHz   | 0.946   | 169.70  | 1.80    | 35.76   | 0.010   | -28.43  | 0.739   | -177.25 |
| 2.2 GHz   | 0.946   | 168.73  | 1.73    | 33.39   | 0.010   | -29.28  | 0.743   | -177.72 |
| 2.3 GHz   | 0.946   | 167.73  | 1.67    | 31.03   | 0.010   | -30.06  | 0.747   | -178.21 |
| 2.4 GHz   | 0.945   | 166.70  | 1.62    | 28.70   | 0.010   | -30.78  | 0.751   | -178.74 |
| 2.5 GHz   | 0.945   | 165.63  | 1.57    | 26.37   | 0.010   | -31.44  | 0.754   | -179.28 |
| 2.6 GHz   | 0.945   | 164.53  | 1.54    | 24.06   | 0.010   | -32.05  | 0.757   | -179.85 |
| 2.7 GHz   | 0.944   | 163.38  | 1.50    | 21.74   | 0.009   | -32.60  | 0.759   | 179.55  |
| 2.8 GHz   | 0.943   | 162.17  | 1.47    | 19.42   | 0.009   | -33.10  | 0.761   | 178.93  |
| 2.9 GHz   | 0.942   | 160.91  | 1.45    | 17.09   | 0.009   | -33.56  | 0.763   | 178.28  |
| 3.0 GHz   | 0.941   | 159.57  | 1.43    | 14.74   | 0.009   | -33.99  | 0.764   | 177.61  |
| 3.2 GHz   | 0.938   | 156.68  | 1.41    | 9.95    | 0.009   | -34.75  | 0.766   | 176.20  |
| 3.4 GHz   | 0.935   | 153.41  | 1.41    | 5.00    | 0.009   | -35.46  | 0.765   | 174.68  |
| 3.6 GHz   | 0.930   | 149.66  | 1.42    | -0.20   | 0.010   | -36.21  | 0.763   | 173.05  |
| 3.8 GHz   | 0.923   | 145.28  | 1.46    | -5.76   | 0.010   | -37.13  | 0.758   | 171.27  |
| 4.0 GHz   | 0.914   | 140.09  | 1.52    | -11.80  | 0.011   | -38.39  | 0.751   | 169.35  |
| 4.2 GHz   | 0.903   | 133.82  | 1.60    | -18.50  | 0.011   | -40.21  | 0.742   | 167.23  |
| 4.4 GHz   | 0.888   | 126.08  | 1.71    | -26.07  | 0.012   | -42.86  | 0.729   | 164.90  |
| 4.6 GHz   | 0.868   | 116.32  | 1.86    | -34.83  | 0.013   | -46.72  | 0.712   | 162.27  |
| 4.8 GHz   | 0.842   | 103.74  | 2.05    | -45.14  | 0.015   | -52.24  | 0.690   | 159.29  |
| 5.0 GHz   | 0.811   | 87.25   | 2.27    | -57.50  | 0.017   | -59.93  | 0.663   | 155.80  |
| 5.2 GHz   | 0.777   | 65.61   | 2.51    | -72.38  | 0.019   | -70.34  | 0.628   | 151.60  |
| 5.4 GHz   | 0.752   | 38.13   | 2.72    | -90.03  | 0.021   | -83.73  | 0.581   | 146.39  |
| 5.6 GHz   | 0.753   | 6.31    | 2.83    | -110.07 | 0.023   | -99.76  | 0.516   | 139.81  |
| 5.8 GHz   | 0.785   | -25.54  | 2.78    | -131.39 | 0.023   | -117.31 | 0.427   | 131.59  |
| 6.0 GHz   | 0.835   | -53.19  | 2.58    | -152.64 | 0.022   | -135.03 | 0.311   | 121.26  |

Download this s-parameter file in ".s2p" format at [http://www.cree.com/products/wireless\\_s-parameters.asp](http://www.cree.com/products/wireless_s-parameters.asp)

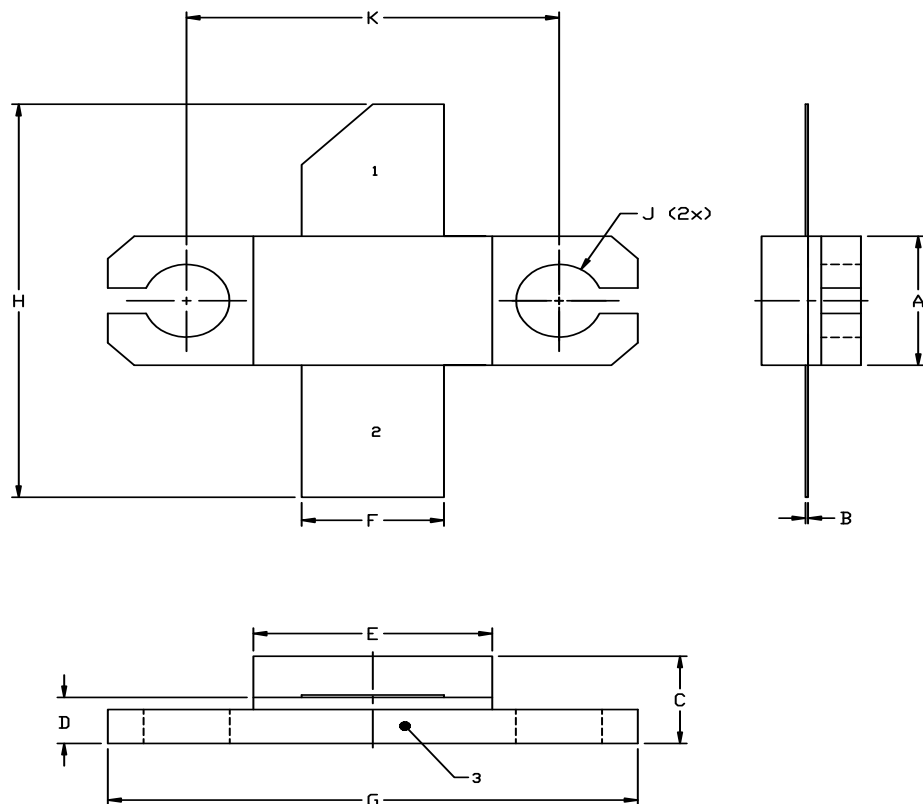


## Typical Package S-Parameters for CGH40045 (Small Signal, $V_{DS} = 28\text{ V}$ , $I_{DQ} = 800\text{ mA}$ , angle in degrees)

| Frequency | Mag S11 | Ang S11 | Mag S21 | Ang S21 | Mag S12 | Ang S12 | Mag S22 | Ang S22 |
|-----------|---------|---------|---------|---------|---------|---------|---------|---------|
| 500 MHz   | 0.952   | -172.90 | 7.23    | 81.83   | 0.009   | -1.13   | 0.688   | -176.19 |
| 600 MHz   | 0.952   | -175.11 | 6.03    | 78.47   | 0.009   | -3.05   | 0.691   | -176.58 |
| 700 MHz   | 0.952   | -176.85 | 5.18    | 75.35   | 0.009   | -4.72   | 0.694   | -176.86 |
| 800 MHz   | 0.952   | -178.32 | 4.54    | 72.38   | 0.009   | -6.21   | 0.696   | -177.07 |
| 900 MHz   | 0.952   | -179.59 | 4.05    | 69.53   | 0.009   | -7.58   | 0.699   | -177.25 |
| 1.0 GHz   | 0.952   | 179.25  | 3.65    | 66.76   | 0.009   | -8.84   | 0.702   | -177.42 |
| 1.1 GHz   | 0.952   | 178.19  | 3.33    | 64.06   | 0.009   | -10.01  | 0.706   | -177.59 |
| 1.2 GHz   | 0.952   | 177.18  | 3.06    | 61.42   | 0.009   | -11.09  | 0.709   | -177.77 |
| 1.3 GHz   | 0.952   | 176.22  | 2.83    | 58.82   | 0.009   | -12.11  | 0.712   | -177.96 |
| 1.4 GHz   | 0.952   | 175.28  | 2.64    | 56.27   | 0.009   | -13.05  | 0.716   | -178.17 |
| 1.5 GHz   | 0.952   | 174.37  | 2.48    | 53.75   | 0.009   | -13.92  | 0.719   | -178.41 |
| 1.6 GHz   | 0.952   | 173.46  | 2.34    | 51.27   | 0.009   | -14.72  | 0.722   | -178.67 |
| 1.7 GHz   | 0.952   | 172.55  | 2.21    | 48.82   | 0.009   | -15.46  | 0.725   | -178.95 |
| 1.8 GHz   | 0.952   | 171.64  | 2.11    | 46.39   | 0.009   | -16.14  | 0.728   | -179.26 |
| 1.9 GHz   | 0.952   | 170.72  | 2.01    | 43.99   | 0.009   | -16.75  | 0.731   | -179.59 |
| 2.0 GHz   | 0.951   | 169.78  | 1.93    | 41.60   | 0.009   | -17.29  | 0.734   | -179.94 |
| 2.1 GHz   | 0.951   | 168.83  | 1.86    | 39.23   | 0.009   | -17.78  | 0.737   | 179.67  |
| 2.2 GHz   | 0.951   | 167.85  | 1.80    | 36.88   | 0.008   | -18.21  | 0.739   | 179.27  |
| 2.3 GHz   | 0.950   | 166.84  | 1.74    | 34.53   | 0.008   | -18.58  | 0.741   | 178.83  |
| 2.4 GHz   | 0.949   | 165.80  | 1.69    | 32.19   | 0.008   | -18.90  | 0.743   | 178.38  |
| 2.5 GHz   | 0.949   | 164.73  | 1.65    | 29.85   | 0.008   | -19.17  | 0.744   | 177.90  |
| 2.6 GHz   | 0.948   | 163.61  | 1.61    | 27.51   | 0.008   | -19.40  | 0.746   | 177.39  |
| 2.7 GHz   | 0.947   | 162.44  | 1.58    | 25.15   | 0.008   | -19.59  | 0.747   | 176.86  |
| 2.8 GHz   | 0.946   | 161.22  | 1.56    | 22.79   | 0.008   | -19.74  | 0.747   | 176.31  |
| 2.9 GHz   | 0.945   | 159.94  | 1.54    | 20.40   | 0.009   | -19.87  | 0.748   | 175.73  |
| 3.0 GHz   | 0.943   | 158.58  | 1.53    | 17.98   | 0.009   | -19.99  | 0.747   | 175.12  |
| 3.2 GHz   | 0.940   | 155.64  | 1.51    | 13.04   | 0.009   | -20.21  | 0.746   | 173.83  |
| 3.4 GHz   | 0.935   | 152.30  | 1.51    | 7.90    | 0.009   | -20.51  | 0.743   | 172.44  |
| 3.6 GHz   | 0.930   | 148.47  | 1.54    | 2.47    | 0.010   | -21.01  | 0.738   | 170.92  |
| 3.8 GHz   | 0.922   | 143.99  | 1.58    | -3.34   | 0.010   | -21.86  | 0.730   | 169.27  |
| 4.0 GHz   | 0.913   | 138.66  | 1.65    | -9.68   | 0.011   | -23.25  | 0.721   | 167.47  |
| 4.2 GHz   | 0.900   | 132.21  | 1.75    | -16.72  | 0.012   | -25.41  | 0.708   | 165.49  |
| 4.4 GHz   | 0.884   | 124.23  | 1.87    | -24.68  | 0.013   | -28.63  | 0.691   | 163.32  |
| 4.6 GHz   | 0.863   | 114.16  | 2.04    | -33.86  | 0.015   | -33.25  | 0.671   | 160.90  |
| 4.8 GHz   | 0.835   | 101.18  | 2.24    | -44.66  | 0.017   | -39.70  | 0.646   | 158.17  |
| 5.0 GHz   | 0.802   | 84.20   | 2.47    | -57.54  | 0.020   | -48.45  | 0.616   | 155.00  |
| 5.2 GHz   | 0.768   | 62.03   | 2.72    | -72.91  | 0.022   | -59.96  | 0.577   | 151.18  |
| 5.4 GHz   | 0.745   | 34.19   | 2.91    | -90.96  | 0.025   | -74.38  | 0.527   | 146.39  |
| 5.6 GHz   | 0.750   | 2.50    | 2.99    | -111.20 | 0.026   | -91.25  | 0.459   | 140.32  |
| 5.8 GHz   | 0.785   | -28.66  | 2.91    | -132.50 | 0.027   | -109.41 | 0.366   | 132.93  |
| 6.0 GHz   | 0.837   | -55.46  | 2.67    | -153.57 | 0.025   | -127.56 | 0.245   | 124.60  |

Download this s-parameter file in ".s2p" format at [http://www.cree.com/products/wireless\\_s-parameters.asp](http://www.cree.com/products/wireless_s-parameters.asp)

## Product Dimensions CGH40045F (Package Type — 440193)



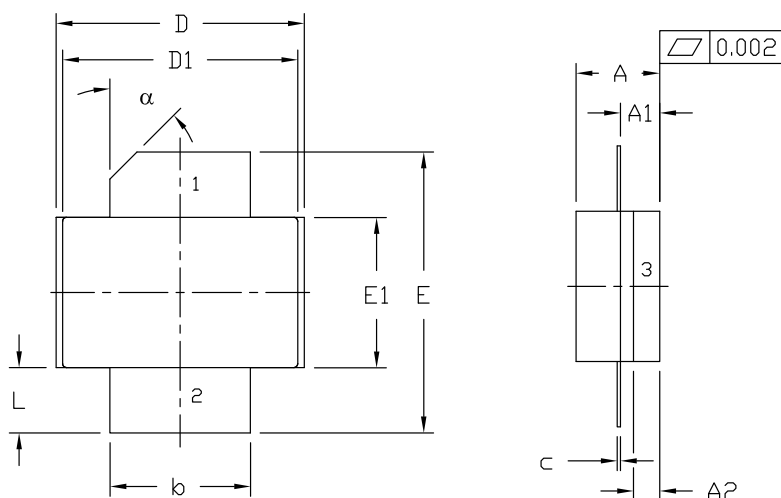
### NOTES:

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   | 0.145       | 0.165 | 3.18        | 4.19  |
| 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   | $\phi$ .130 |       | 3.30        |       |
| k   | 0.562       |       | 14.28       |       |

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

## Product Dimensions CGH40045P (Package Type — 440206)



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M - 1994.
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 PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

| DIM   | INCHES  |       | MILLIMETERS |       | NOTES |
|-------|---------|-------|-------------|-------|-------|
|       | MIN     | MAX   | MIN         | MAX   |       |
| A     | 0.125   | 0.145 | 3.18        | 3.68  |       |
| A1    | 0.057   | 0.067 | 1.45        | 1.70  |       |
| A2    | 0.035   | 0.045 | 0.89        | 1.14  |       |
| b     | 0.210   | 0.220 | 5.33        | 5.59  | 2x    |
| c     | 0.004   | 0.006 | 0.10        | 0.15  | 2x    |
| D     | 0.375   | 0.385 | 9.53        | 9.78  |       |
| D1    | 0.355   | 0.365 | 9.02        | 9.27  |       |
| E     | 0.400   | 0.460 | 10.16       | 11.68 |       |
| E1    | 0.225   | 0.235 | 5.72        | 5.97  |       |
| L     | 0.085   | 0.115 | 2.16        | 2.92  | 2x    |
| alpha | 45° REF |       | 45° REF     |       |       |

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



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