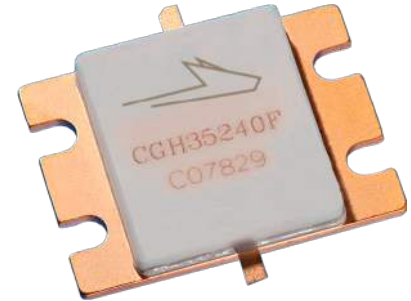


# CGH35240F

240 W, 3.1-3.5 GHz, 50-ohm Input/Output Matched,  
GaN HEMT for S-Band Radar Systems



Package Types: 440201  
PN: CGH35240F

## Description

WolfSpeed's CGH35240F is a gallium nitride (GaN) high electron mobility transistor (HEMT) designed specifically with high efficiency, high gain and wide bandwidth capabilities, which makes the CGH35240F ideal for 3.1-3.5 GHz S-Band radar amplifier applications. The transistor is supplied in a ceramic/metal flange package.

## Typical Performance Over 3.1-3.5 GHz ( $T_c = 25^\circ\text{C}$ ) of Demonstration Amplifier

| Parameter              | 3.1 GHz | 3.2 GHz | 3.3 GHz | 3.4 GHz | 3.5 GHz | Units |
|------------------------|---------|---------|---------|---------|---------|-------|
| Outdoor Power          | 250     | 240     | 225     | 225     | 220     | W     |
| Gain                   | 12.1    | 11.9    | 11.6    | 11.5    | 11.4    | dB    |
| Power Added Efficiency | 60      | 59      | 57      | 52      | 48      | %     |

Note: Measured in the CGH35240F-AMP amplifier circuit, under 300  $\mu\text{s}$  pulse width, 20% duty cycle,  $P_{IN} = 42 \text{ dBm}$

## Features

- 3.1 - 3.5 GHz Operation
- 240 W Typical Output Power
- 11.6 dB Power Gain at  $P_{IN} = 42.0 \text{ dBm}$
- 57% Typical Power Added Efficiency
- 50 ohm Internally Matched
- <0.2 dB Pulsed Amplitude Droop



Large Signal Models Available for ADS and MWO





## Absolute Maximum Ratings (not simultaneous) at 25°C Case Temperature

| Parameter  | Symbol          | Rating    | Units | Conditions |
|--|-----------------|-----------|-------|------------|
| Pulse Width  | PW              | 1         | ms    |            |
| Duty Cycle   | DC              | 50        | %     |            |
| Drain-Source Voltage                                     | $V_{DISS}$      | 120       | V     | 25°C       |
| Gate-to-Source Voltage                                   | $V_{GS}$        | -10, +2   |       |            |
| Power Dissipation  | $P_{DISS}$      | 345       | W     |            |
| Storage Temperature                                      | $T_{STG}$       | -65, +150 | °C    |            |
| Operating Junction Temperature                           | $T_J$           | 225       |       |            |
| Maximum Forward Gate Current                             | $I_{GMAX}$      | 60        | mA    | 25°C       |
| Maximum Drain Current <sup>1</sup>                       | $I_{DMAX}$      | 24        | A     |            |
| Soldering Temperature <sup>2</sup>                       | $T_S$           | 245       | °C    |            |
| Screw Torque   | $\tau$          | 40        | in-oz |            |
| Pulsed Thermal Resistance, Junction to Case <sup>3</sup> | $R_{\theta JC}$ | 0.5       | °C/W  | 85°C       |
| Case Operating Temperature <sup>3</sup>                  | $T_C$           | -40, +150 | °C    |            |

Notes:

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

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

<sup>3</sup> Measured for the CGH35240F at  $P_{DISS} = 280$  W. Pulse Width = 300  $\mu$ S, Duty Cycle = 20%

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

| Parameter  | 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, $I_D = 57.6$ mA                     |
| Gate Quiescent Voltage   | $V_{GS(Q)}$  | —    | -2.7 | —    |          | $V_{DS} = 28$ V, $I_D = 1.0$ A                       |
| Saturated Drain Current <sup>2</sup>   | $I_{DS}$     | 46.4 | 56.0 | —    | A        | $V_{DS} = 6.0$ V, $V_{GS} = 2.0$ V                   |
| Drain-Source Breakdown Voltage   | $V_{BR}$     | 84   | —    | —    | $V_{DC}$ | $V_{GS} = -8$ V, $I_D = 57.6$ mA                     |
| <b>RF Characteristics<sup>2</sup> (<math>T_C = 25^\circ\text{C}</math>, <math>F_0 = 3.1</math>-3.5 GHz unless otherwise noted)</b> |              |      |      |      |          |  |
| Output Power <sub>1</sub> at 3.1 GHz   | $P_{OUT}$    | 210  | 250  | —    | W        | $V_{DD} = 28$ V, $I_{DQ} = 1.0$ A, $P_{IN} = 42$ dBm |
| Output Power <sub>2</sub> at 3.3 GHz   |              | 200  | 225  | —    |          |  |
| Output Power <sub>3</sub> at 3.5 GHz   |              | 180  | 220  | —    |          |  |
| Power Added Efficiency <sub>1</sub> at 3.1 GHz   | PAE          | 48   | 60   | —    | %        |  |
| Power Added Efficiency <sub>2</sub> at 3.3 GHz   |              | 57   | —    | —    |          |  |
| Power Added Efficiency <sub>3</sub> at 3.5 GHz   |              | 40   | 48   | —    |          |  |
| Power Gain <sub>1</sub> at 3.1 GHz   | $G_p$        | 11.0 | 12.0 | —    | dB       |  |
| Power Gain <sub>2</sub> at 3.3 GHz   |              | 10.8 | 11.5 | —    |          |  |
| Power Gain <sub>3</sub> at 3.5 GHz   |              | 10.5 | —    | —    |          |  |
| Small Signal Gain  | S21          | 11.4 | 14   | —    | dB       |  |
| Input Return Loss  | S11          | —    | -9   | -4.5 |          |  |
| Output Return Loss   | S22          | —    | -10  |      |          |  |
| Pulsed Amplitude Droop   | D            | —    | 0.1  | —    |          | $V_{DD} = 28$ V, $I_{DQ} = 1.0$ A                    |

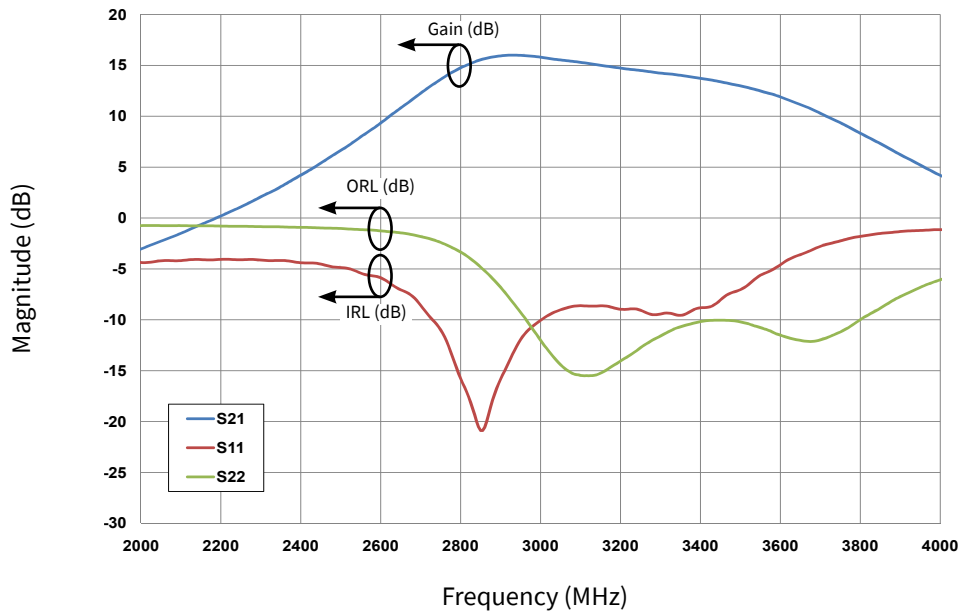
Notes:

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

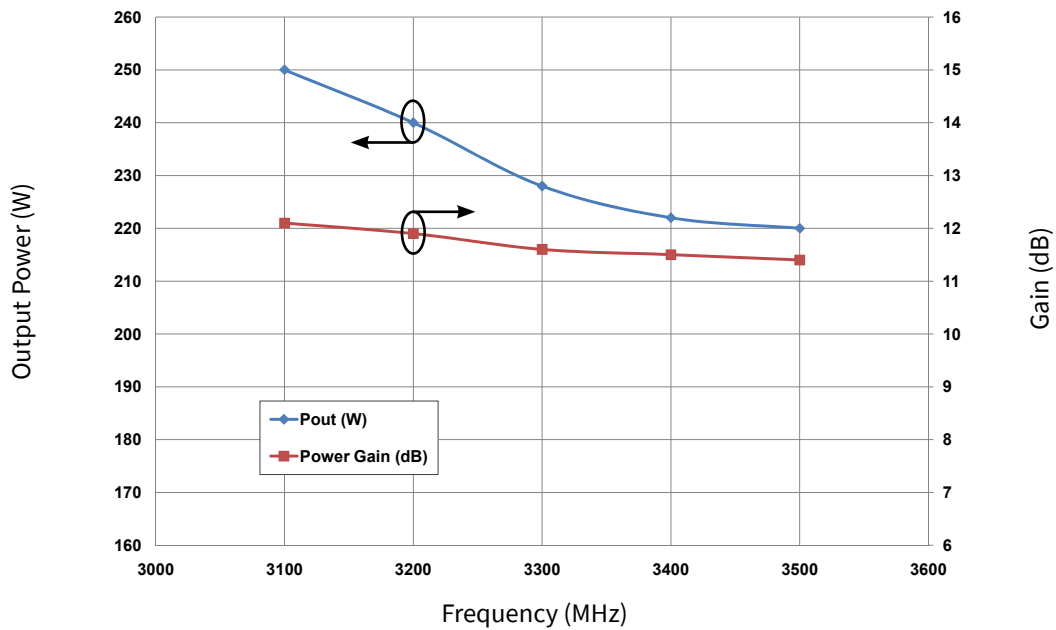
<sup>2</sup> Measured in CGH35240F-AMP. Pulse Width = 300  $\mu$ S, Duty Cycle = 20%



Typical Performance



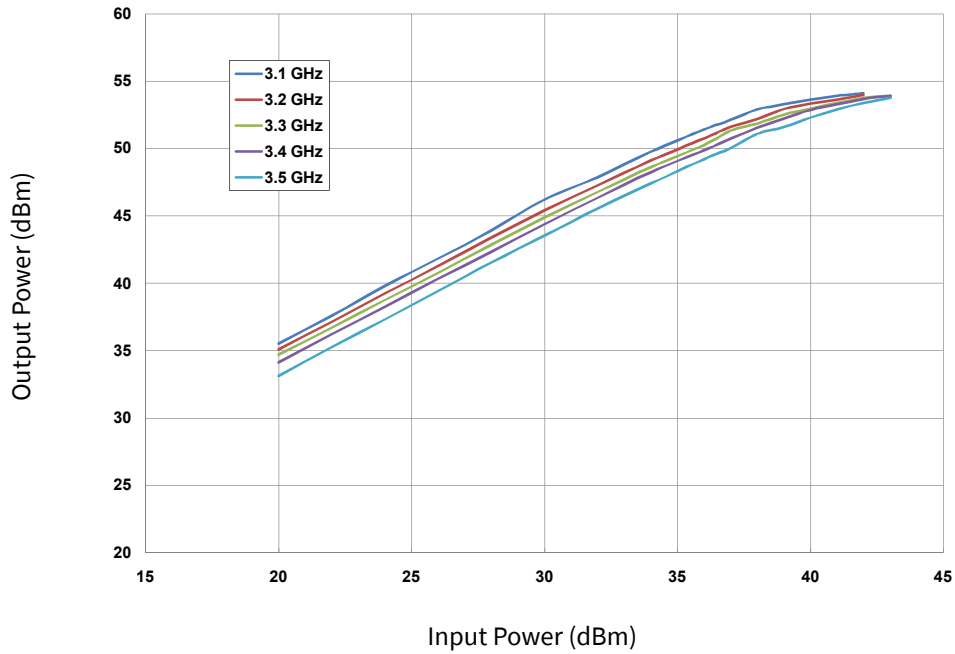
**Figure 1.** Gain and Return Losses vs Frequency Measured in CGH35240-AMP Amplifier Circuit  
 $V_{DS} = 28\text{ V}$ ,  $I_{DS} = 1\text{ A}$



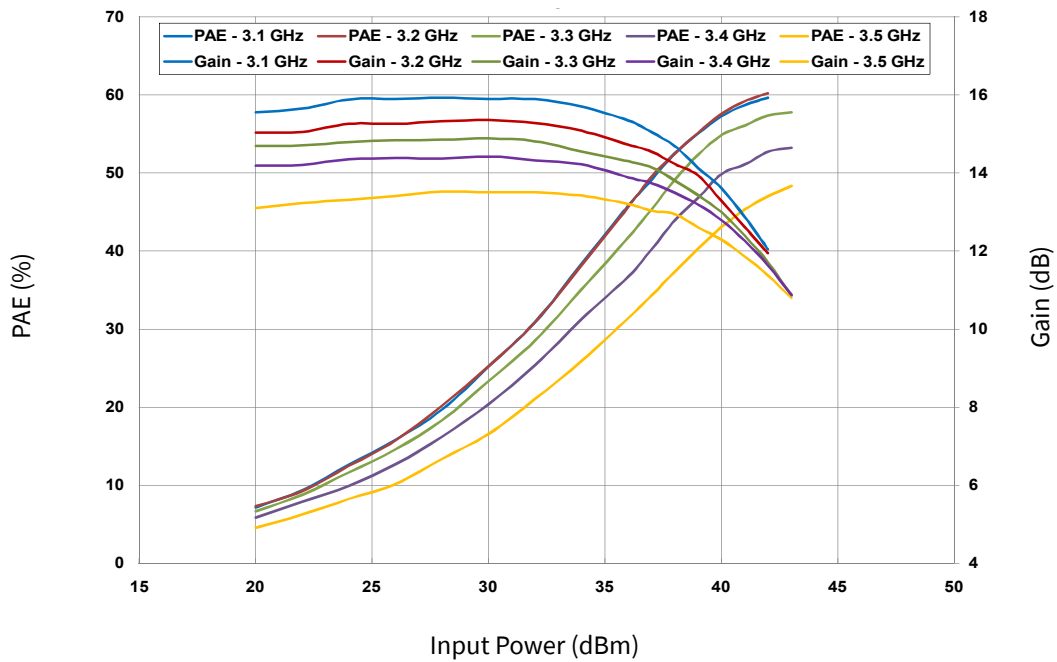
**Figure 2.** Typical Pulsed Output Power and Power Gain vs Frequency Measured in CGH35240-AMP Amplifier Circuit  
 $V_{DS} = 28\text{ V}$ ,  $I_{DS} = 1\text{ A}$ ,  $P_{IN} = 42\text{ dBm}$ , Pulse Width =  $300\text{ }\mu\text{s}$ , Duty Cycle = 20%



Typical Performance



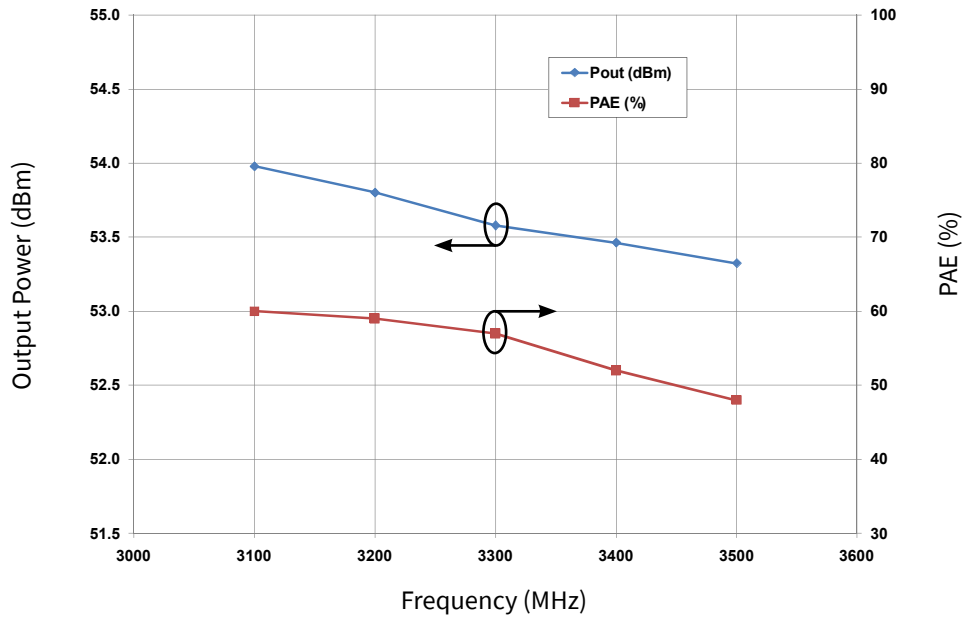
**Figure 3.** CGH35240 Output Power vs Input Power  
 $V_{DS} = 28\text{ V}$ ,  $I_{DS} = 1\text{ A}$ , Pulse Width = 300  $\mu\text{S}$ , Duty Cycle = 20%



**Figure 4.** CGH35240 PAE & Gain vs Input Power  
 $V_{DS} = 28\text{ V}$ ,  $I_{DS} = 1\text{ A}$ , Pulse Width = 300  $\mu\text{S}$ , Duty Cycle = 20%

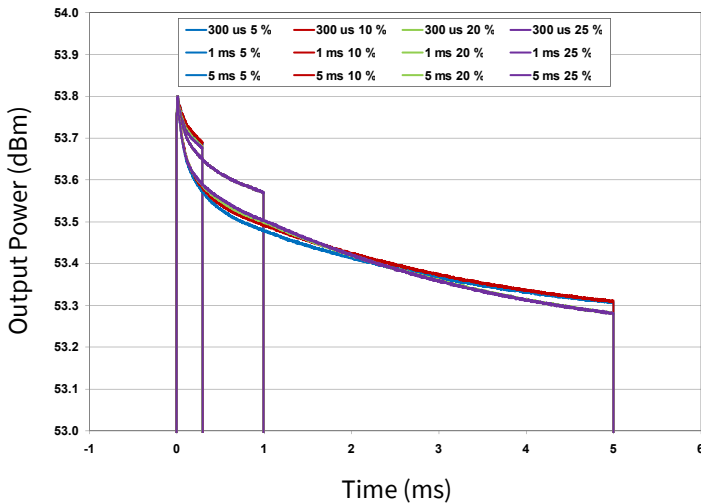


### Typical Performance



**Figure 5.** Typical Pulsed Output Power and Power Added Efficiency vs Frequency Measured in CGH35240-AMP Amplifier Circuit  
 $V_{DS} = 28\text{ V}$ ,  $I_{DS} = 1\text{ A}$ ,  $PIN = 42\text{ dBm}$ , Pulse Width =  $300\text{ }\mu\text{s}$ , Duty Cycle = 20%

### Typical Pulse Droop Performance



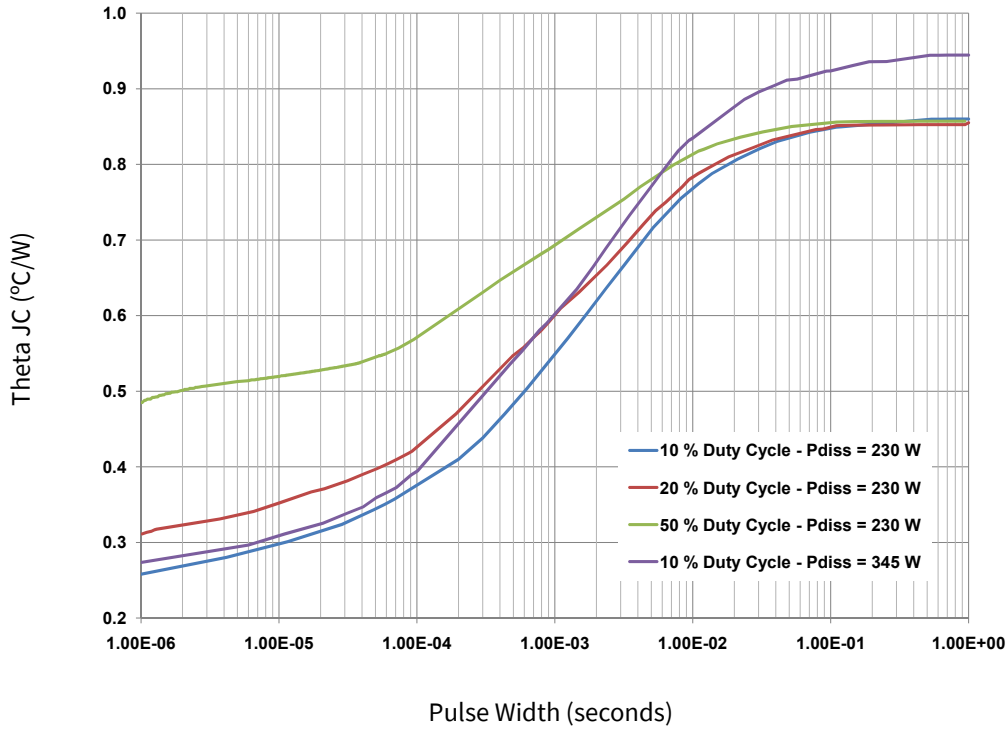
| Pulse Width | Duty Cycle (%) | Droop (dB) |
|-------------|----------------|------------|
| 10 us       | 5-25           | 0.05       |
| 50 us       | 5-25           | 0.05       |
| 100 us      | 5-25           | 0.10       |
| 300 us      | 5-25           | 0.15       |
| 1 ms        | 5-25           | 0.30       |
| 5 ms        | 5-25           | 0.60       |

### Electrostatic Discharge (ESD) Classifications

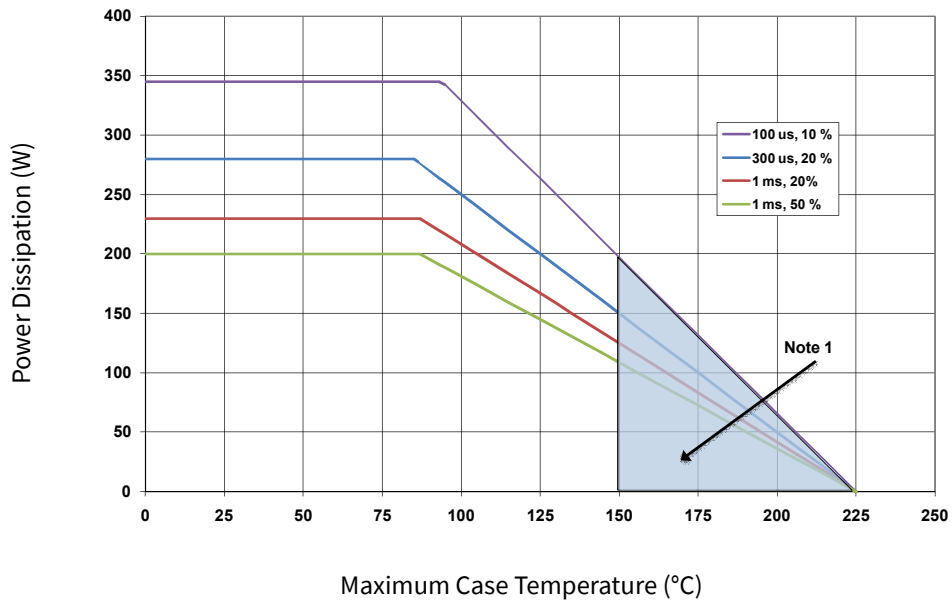
| Parameter           | Symbol | Class | Classification Level           | Test Methodology    |
|---------------------|--------|-------|--------------------------------|---------------------|
| Human Body Model    | HBM    | 1C    | ANSI/ESDA/JEDEC JS-001 Table 3 | JEDEC JESD22 A114-D |
| Charge Device Model | CDM    | C3    | ANSI/ESDA/JEDEC JS-002 Table 3 | JEDEC JESD22 C101-C |



### CGH35240F Transient Thermal Curve



### CGH35240 Power Dissipation De-rating Curve



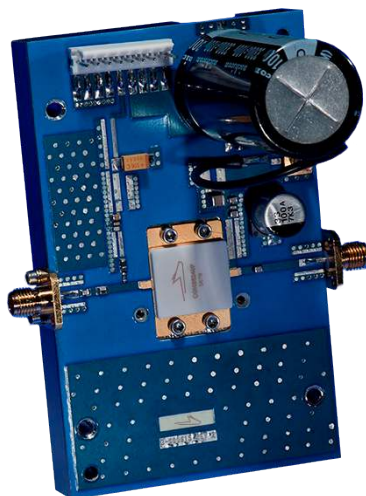
Note:  
<sup>1</sup> Area exceeds Maximum Case Operating Temperature (See Page 2)



## CGH35240F-AMP Demonstration Amplifier Circuit Bill of Materials

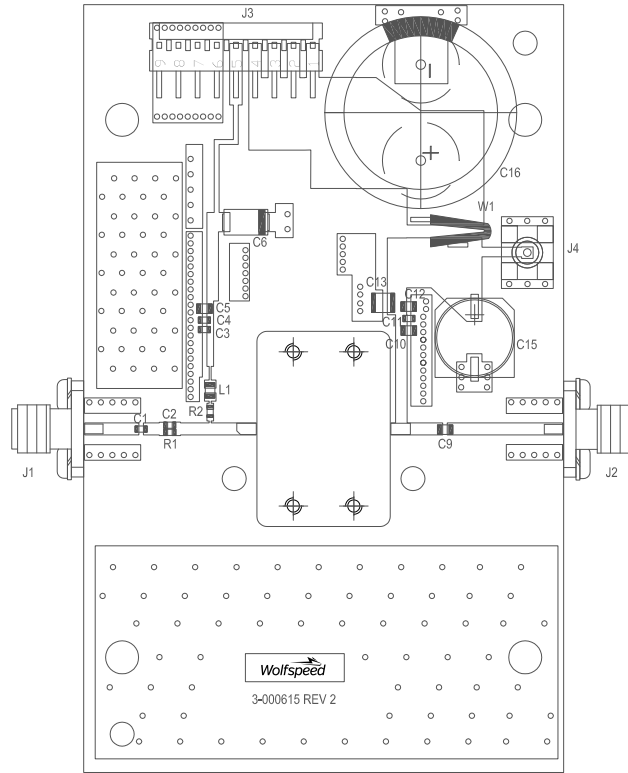
| Designator | Description                                   | Qty |
|------------|---|-----|
| R1         | RES, 511, ohm, +/- 1%, 1/16W, 0603            | 1   |
| R2         | RES, 5.1, ohm, +/- 1%, 1/16W, 0603            | 1   |
| C1, C3     | CAP, 10.0pF, +/-5%, 250V, 0603                | 2   |
| C2         | CAP, 6.8pF, +/- 0.25 pF, 250V, 0603           | 1   |
| C4, C11    | CAP, 470pF, +/-5%, 100V, 0603, X              | 2   |
| C15        | CAP, 33 $\mu$ F, 20%, G CASE                  | 1   |
| C5, C12    | CAP, 33000pF, 0805, 100V, X7R                 | 2   |
| C13        | CAP, 1.0 $\mu$ F, 100V, 10%, X7R, 1210        | 1   |
| C6         | CAP, 10 $\mu$ F, 16V, TANTALUM                | 1   |
| C9, C10    | CAP, 10pF, +/- 1%, 250V, 0805                 | 2   |
| C16        | CAP, 3300 $\mu$ F, +/-20%, 100V, ELECTROLYTIC | 1   |
| J1, J2     | CONN, SMA, PANEL MOUNT JACK, FL               | 2   |
| J3         | HEADER RT>PLZ .1CEN LK 9POS                   | 1   |
| J4         | CONNECTOR ; SMB, Straight, JACK, SMD          | 1   |
| W1         | CABLE, 18 AWG, 4.2                            | 1   |
| L1         | FERRITE, 22 ohm, 0805, BLM21PG220SN1          | 1   |
| -          | PCB, RO4350, 2.5 X 4.0 X 0.030                | 1   |
| Q1         | CGH35240F                                     | 1   |

## CGH35240F-AMP Demonstration Amplifier Circuit

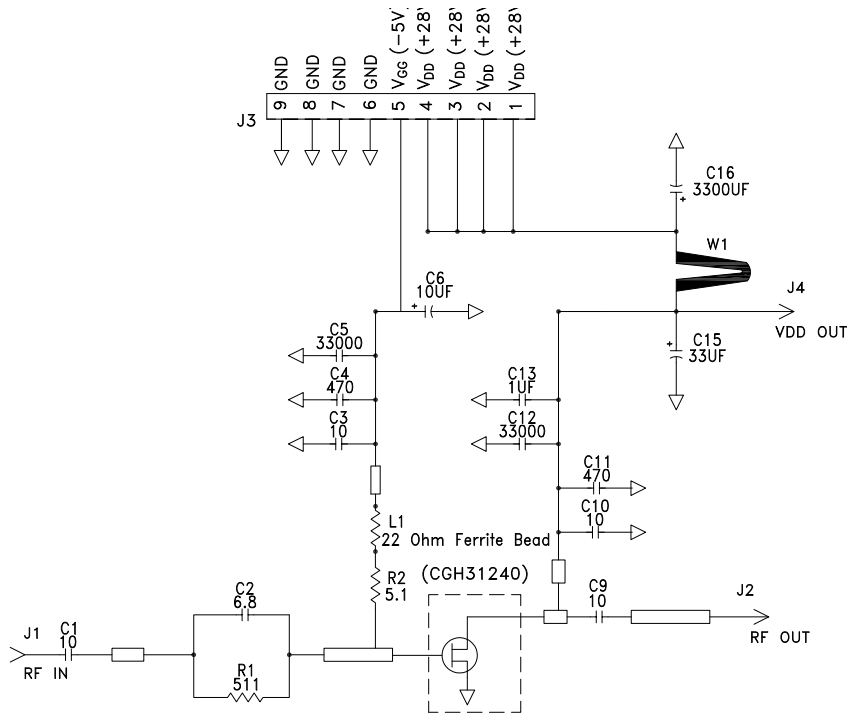




### CGH35240F-AMP Demonstration Amplifier Circuit Schematic



### CGH35240F-AMP Demonstration Amplifier Circuit Schematic







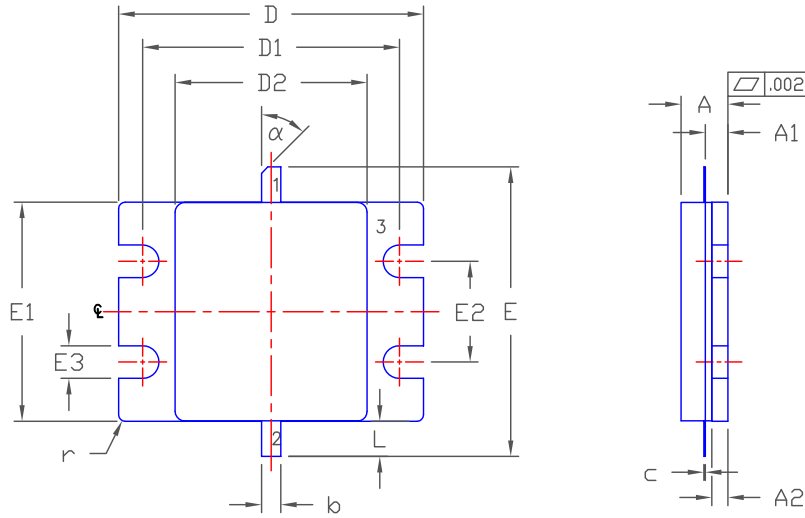
**Typical Package S-Parameters for CGH35240F**  
 (Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 1000\text{ mA}$ , angle in degrees)

| Frequency | Mag S11 | Ang S11 | Mag S21 | Ang S21 | Mag S12 | Ang S12 | Mag S22 | Ang S22  |
|-----------|---------|---------|---------|---------|---------|---------|---------|----------|
| 500 MHz   | 0.909   | -110.39 | 0.67    | 85.30   | 0.001   | 7.79    | 0.931   | -175.71  |
| 600 MHz   | 0.887   | -133.63 | 0.68    | 52.25   | 0.001   | -22.14  | 0.926   | 161.61   |
| 700 MHz   | 0.861   | -157.29 | 0.67    | 21.72   | 0.002   | -50.42  | 0.925   | 140.70   |
| 800 MHz   | 0.831   | 178.80  | 0.65    | -6.95   | 0.002   | -74.38  | 0.924   | 120.94   |
| 900 MHz   | 0.800   | 154.60  | 0.64    | -34.16  | 0.002   | -110.45 | 0.924   | 101.95   |
| 1.0 GHz   | 0.770   | 130.18  | 0.63    | -60.27  | 0.002   | -135.64 | 0.924   | 83.44    |
| 1.2 GHz   | 0.723   | 80.74   | 0.64    | -110.13 | 0.002   | 166.59  | 0.919   | 46.75    |
| 1.4 GHz   | 0.698   | 29.48   | 0.69    | -160.34 | 0.002   | 127.53  | 0.896   | 9.09     |
| 1.6 GHz   | 0.618   | -28.54  | 0.76    | 137.30  | 0.004   | 116.81  | 0.766   | -28.92   |
| 1.8 GHz   | 0.443   | -48.39  | 0.45    | 107.33  | 0.003   | 53.00   | 0.861   | -47.01   |
| 2.0 GHz   | 0.569   | -89.52  | 0.69    | 73.39   | 0.003   | -0.59   | 0.915   | -88.98   |
| 2.1 GHz   | 0.594   | -111.61 | 0.83    | 51.20   | 0.004   | -23.48  | 0.913   | -108.69  |
| 2.2 GHz   | 0.606   | -133.58 | 1.01    | 28.33   | 0.005   | -45.69  | 0.908   | -128.26  |
| 2.3 GHz   | 0.607   | -155.92 | 1.25    | 4.25    | 0.007   | -71.50  | 0.902   | -148.11  |
| 2.4 GHz   | 0.595   | -179.54 | 1.59    | -21.28  | 0.009   | -99.04  | 0.895   | -168.80  |
| 2.5 GHz   | 0.561   | 154.35  | 2.11    | -49.48  | 0.013   | -129.12 | 0.883   | 169.09   |
| 2.6 GHz   | 0.499   | 124.82  | 2.87    | -80.80  | 0.018   | -161.39 | 0.861   | 144.62   |
| 2.7 GHz   | 0.376   | 85.52   | 4.03    | -118.36 | 0.027   | 161.11  | 0.813   | 115.40   |
| 2.8 GHz   | 0.177   | 20.59   | 5.38    | -164.13 | 0.039   | 115.01  | 0.690   | 79.55    |
| 2.9 GHz   | 0.165   | -127.79 | 6.17    | 144.62  | 0.049   | 64.36   | 0.480   | 37.79    |
| 3.0 GHz   | 0.309   | 163.81  | 6.11    | 96.28   | 0.052   | 15.24   | 0.288   | -7.26    |
| 3.1 GHz   | 0.354   | 118.49  | 5.80    | 52.70   | 0.052   | -28.98  | 0.208   | -64.36   |
| 3.2 GHz   | 0.329   | 74.79   | 5.47    | 11.41   | 0.052   | -70.29  | 0.236   | -120.98  |
| 3.3 GHz   | 0.286   | 23.15   | 5.19    | -29.09  | 0.052   | -110.99 | 0.302   | -160.98  |
| 3.4 GHz   | 0.300   | -38.01  | 4.94    | -70.05  | 0.052   | -151.88 | 0.354   | 167.78   |
| 3.5 GHz   | 0.406   | -96.34  | 4.55    | -112.29 | 0.050   | 165.57  | 0.350   | 142.39   |
| 3.6 GHz   | 0.565   | -143.08 | 4.00    | -154.80 | 0.046   | 122.85  | 0.300   | 127.36   |
| 3.7 GHz   | 0.708   | 177.87  | 3.32    | 163.85  | 0.040   | 81.34   | 0.271   | 127.66   |
| 3.8 GHz   | 0.799   | 143.73  | 2.64    | 125.19  | 0.033   | 42.95   | 0.321   | 129.68   |
| 3.9 GHz   | 0.847   | 113.69  | 2.09    | 89.39   | 0.027   | 7.05    | 0.410   | 122.23   |
| 4.0 GHz   | 0.868   | 85.65   | 1.65    | 56.14   | 0.022   | -25.45  | 0.497   | 108.92   |
| 4.2 GHz   | 0.853   | 30.51   | 1.10    | -6.76   | 0.016   | -84.72  | 0.622   | 78.62    |
| 4.4 GHz   | 0.803   | -32.21  | 0.75    | -69.35  | 0.012   | -148.46 | 0.700   | 47.77    |
| 4.6 GHz   | 0.765   | -101.68 | 0.51    | -131.73 | 0.008   | 147.89  | 0.743   | 16.36    |
| 4.8 GHz   | 0.770   | -166.93 | 0.32    | 167.88  | 0.005   | 101.70  | 0.762   | -17.52   |
| 5.0 GHz   | 0.785   | 141.18  | 0.20    | 113.11  | 0.004   | 59.25   | 0.747   | -56.70   |
| 5.2 GHz   | 0.786   | 100.39  | 0.13    | 60.03   | 0.005   | 5.11    | 0.676   | -106.08  |
| 5.4 GHz   | 0.761   | 65.91   | 0.08    | -1.66   | 0.007   | -83.46  | 0.447   | -179.99  |
| 5.6 GHz   | 0.691   | 35.57   | 0.03    | -48.77  | 0.005   | 159.03  | 0.055   | 2 122.03 |
| 5.8 GHz   | 0.608   | 11.51   | 0.02    | -59.15  | 0.004   | 57.07   | 0.310   | 23.86    |
| 6.0 GHz   | 0.604   | -18.74  | 0.01    | -102.12 | 0.003   | -9.32   | 0.594   | -75.04   |

To download the s-parameters in s2p format, go to the [CGH35240F](#) Product page and click on the documentation tab.



**Product Dimensions CGH35240F (Package Type — 440201)**



NOTES:

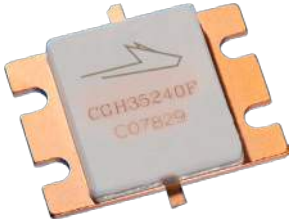

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M - 1994.
2. CONTROLLING DIMENSION: INCH.
3. ADHESIVE FROM LID MAY EXTEND A MAXIMUM OF 0.020" BEYOND EDGE OF LID.
4. LID MAY BE MISALIGNED TO THE BODY OF PACKAGE BY A MAXIMUM OF 0.008" IN ANY DIRECTION.

| DIM   | INCHES   |       | MILLIMETERS |       | NOTES |
|-------|----------|-------|-------------|-------|-------|
|       | MIN      | MAX   | MIN         | MAX   |       |
| A     | 0.128    | 0.148 | 3.25        | 3.76  |       |
| A1    | 0.057    | 0.067 | 1.45        | 1.70  |       |
| A2    | 0.035    | 0.045 | 0.89        | 1.14  |       |
| b     | 0.055    | 0.065 | 1.40        | 1.65  | 2x    |
| c     | 0.004    | 0.007 | 0.08        | 0.15  |       |
| D     | 0.948    | 0.958 | 24.08       | 24.33 |       |
| D1    | 0.798    | 0.808 | 20.27       | 20.52 |       |
| D2    | 0.595    | 0.605 | 15.11       | 15.37 |       |
| E     | 0.880    | 0.930 | 22.35       | 23.62 |       |
| E1    | 0.680    | 0.694 | 17.27       | 17.63 |       |
| E2    | 0.310    | 0.320 | 7.87        | 8.13  |       |
| E3    | 0.097    | 0.107 | 2.46        | 2.72  | 4x    |
| L     | 0.095    | 0.125 | 2.41        | 3.18  | 2x    |
| r     | 0.02 TYP |       | 0.51 TYP    |       | 4x    |
| alpha | 45° REF  |       | 45° REF     |       |       |

- PIN 1. GATE  
 2. DRAIN  
 3. SOURCE



## Product Ordering Information

| Order Number  | Description                        | Unit of Measure | Image  |
|---------------|------------------------------------|-----------------|--|
| CGH35240F     | GaN HEMT                           | Each            |  A photograph of a GaN HEMT device. It is a small, rectangular, light-colored component with four gold-colored mounting tabs. The top surface is marked with the part number 'CGH35240F' and the lot number 'C07829' in red ink, along with a stylized lightning bolt logo. |
| CGH35240F-AMP | Test board with GaN HEMT installed | Each            |  A photograph of a blue printed circuit board (PCB) test board. It features various electronic components, including a large black component, several resistors, and connectors. The GaN HEMT device is mounted on the board.   |

**For more information, please contact:**

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[www.wolfspeed.com/RF](http://www.wolfspeed.com/RF)

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RF Product Marketing Contact  
[RFMarketing@wolfspeed.com](mailto:RFMarketing@wolfspeed.com)

## Notes & Disclaimer

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