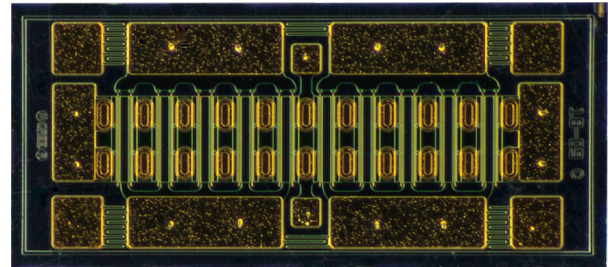


CGHV60040D

40 W, 6.0 GHz, GaN HEMT Die

Description

Cree's CGHV60040D 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: CGHV60040D

Features

- 18 dB Typical Small Signal Gain at 4 GHz
- 17 dB Typical Small Signal Gain at 6 GHz
- 65% Typical Power Added Efficiency
- 40 W Typical P_{SAT}
- 50 V Operation
- High Breakdown Voltage
- Up to 6 GHz Operation

Applications

- Cellular Infrastructure
- Class A, AB, Linear amplifiers suitable for OFDM, W-CDMA, LTE, 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)

| Parameter | Symbol | Rating | Units | Conditions |
|--|-----------------|-----------|----------|--------------------------|
| Drain source Voltage | V_{DSS} | 150 | V_{DC} | 25 °C |
| Gate source Voltage | V_{GS} | -10, +2 | V_{DC} | 25 °C |
| Storage Temperature | T_{STG} | -65, +150 | °C | |
| Operating Junction Temperature | T_J | 225 | °C | |
| Maximum Drain Current ¹ | I_{MAX} | 3.2 | A | 25 °C |
| Maximum Forward Gate Current | I_{GMAX} | 5.2 | mA | 25 °C |
| Thermal Resistance, Junction to Case (packaged) ² | $R_{\theta JC}$ | 5.10 | °C/W | 85 °C, 20.8W Dissipation |
| Thermal Resistance, Junction to Case (die only) | $R_{\theta JC}$ | 3.27 | °C/W | 85 °C, 20.8W Dissipation |
| Mounting Temperature | T_S | 320 | °C | 30 seconds |

Notes:

¹ Current limit for long term, reliable operation² Eutectic die attach using 80/20 AuSn mounted to a 10 mil thick Cu15Mo85 carrier**Electrical Characteristics (Frequency = 6 GHz unless otherwise stated; $T_c = 25^\circ\text{C}$)**

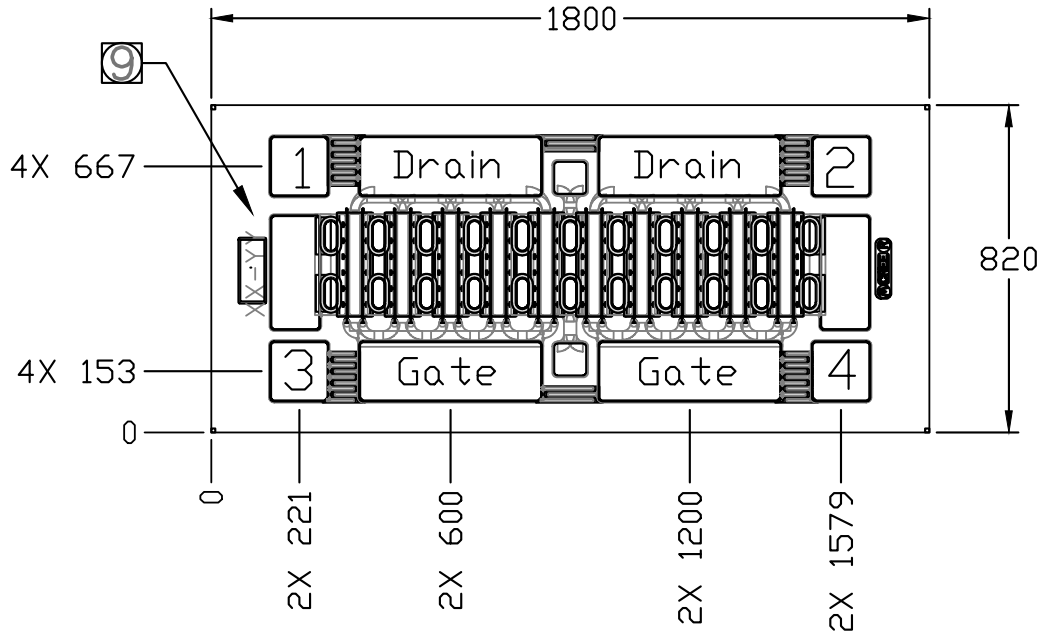
| Characteristics | Symbol | Min. | Typ. | Max. | Units | Conditions |
|---------------------------------------|------------|------|------|--------|----------|---|
| DC Characteristics | | | | | | |
| Gate Pinch-Off Voltage | V_P | -3.8 | -3.0 | -2.3 | V | $V_{DS} = 10\text{ V}, I_D = 5.2\text{ mA}$ |
| Drain Current ¹ | I_{DSS} | 4.2 | 5.2 | - | A | $V_{DS} = 6\text{ V}, V_{GS} = 2.0\text{ V}$ |
| Drain-Source Breakdown Voltage | V_{BD} | 125 | - | - | V | $V_{GS} = -8\text{ V}, I_D = 5.2\text{ mA}$ |
| On Resistance | R_{ON} | - | 0.56 | - | Ω | $V_{DS} = 0.1\text{ V}$ |
| Gate Forward Voltage | V_{G-ON} | - | 1.9 | - | V | $I_{GS} = 5.2\text{ mA}$ |
| RF Characteristics | | | | | | |
| Small Signal Gain | G_{SS} | - | 17 | - | dB | $V_{DD} = 50\text{ V}, I_{DQ} = 65\text{ mA}$ |
| Saturated Power Output ^{2,3} | P_{SAT} | - | 40 | - | W | $V_{DD} = 50\text{ V}, I_{DQ} = 65\text{ mA}$ |
| Drain Efficiency ⁴ | η | - | 65 | - | % | $V_{DD} = 50\text{ V}, I_{DQ} = 65\text{ mA}, P_{SAT} = 40\text{ W}$ |
| Intermodulation Distortion | IM3 | - | -30 | - | dBc | $V_{DD} = 50\text{ V}, I_{DQ} = 65\text{ mA}, P_{OUT} = 40\text{ W PEP}$ |
| Output Mismatch Stress | VSWR | - | - | 10 : 1 | Ψ | No damage at all phase angles, $V_{DD} = 50\text{ V}, I_{DQ} = 65\text{ mA}, P_{OUT} = 40\text{ W CW}$ |
| Dynamic Characteristics | | | | | | |
| Input Capacitance | C_{GS} | - | 7.1 | - | pF | $V_{DS} = 50\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$ |
| Output Capacitance | C_{DS} | - | 1.6 | - | pF | $V_{DS} = 50\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$ |
| Feedback Capacitance | C_{GD} | - | 0.15 | - | pF | $V_{DS} = 50\text{ V}, V_{GS} = -8\text{ V}, f = 1\text{ MHz}$ |

Notes:

¹ Scaled from PCM data² P_{SAT} is defined as $I_G = 0.52\text{ mA}$ ³ Pulsed 100 μsec , 10%⁴ Drain Efficiency = P_{OUT} / P_{DC}



DIE Dimensions (units in microns)



Overall die size 820 x 1800 (+0/- 50) microns, die thickness 100 microns.
 All Gate and Drain pads must be wire bonded for electrical connection.

| Pad | Size (microns) |
|--------------|----------------|
| Drain | 464 x 156 |
| Gate | 464 x 156 |
| Interconnect | 156 x 152 |

Assembly Notes:

- Recommended solder is AuSn (80/20) solder. Refer to Cree’s website for the Eutectic Die Bond Procedure application note at http://www.cree.com/products/wireless_documents.asp
- 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 Performance

Figure 1. CGHV60040D Output Power, Gain and Efficiency vs. Input Power at Tcase = 25°C
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 65\text{ mA}$, Frequency = 2.7 GHz

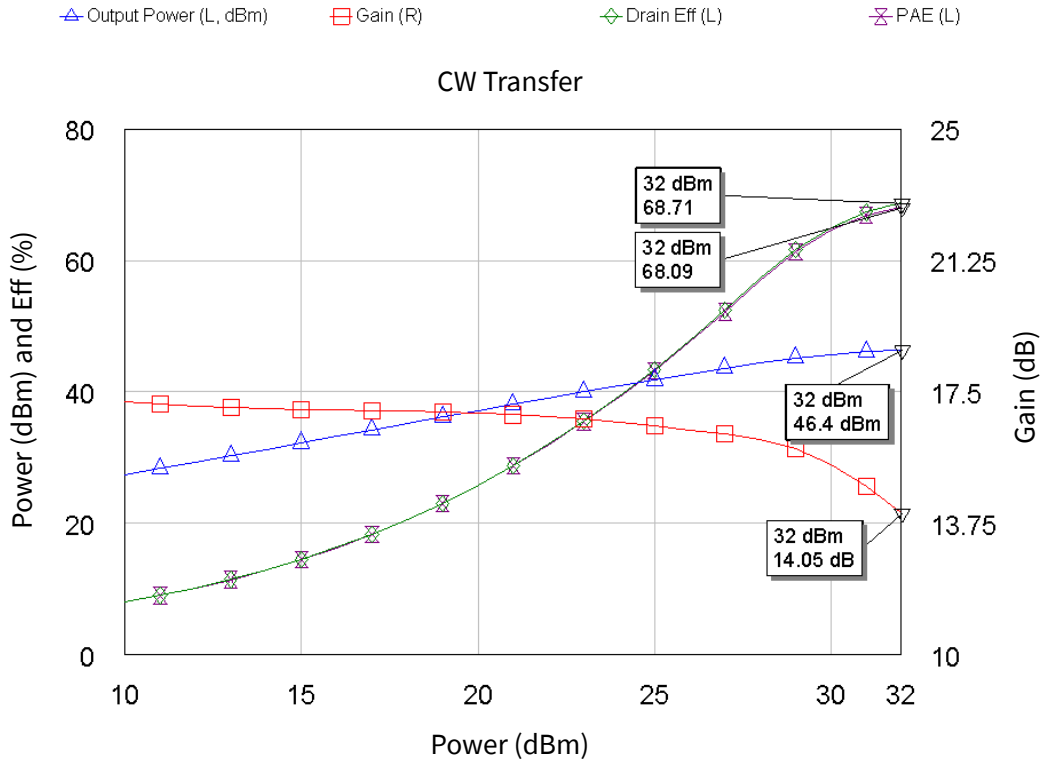
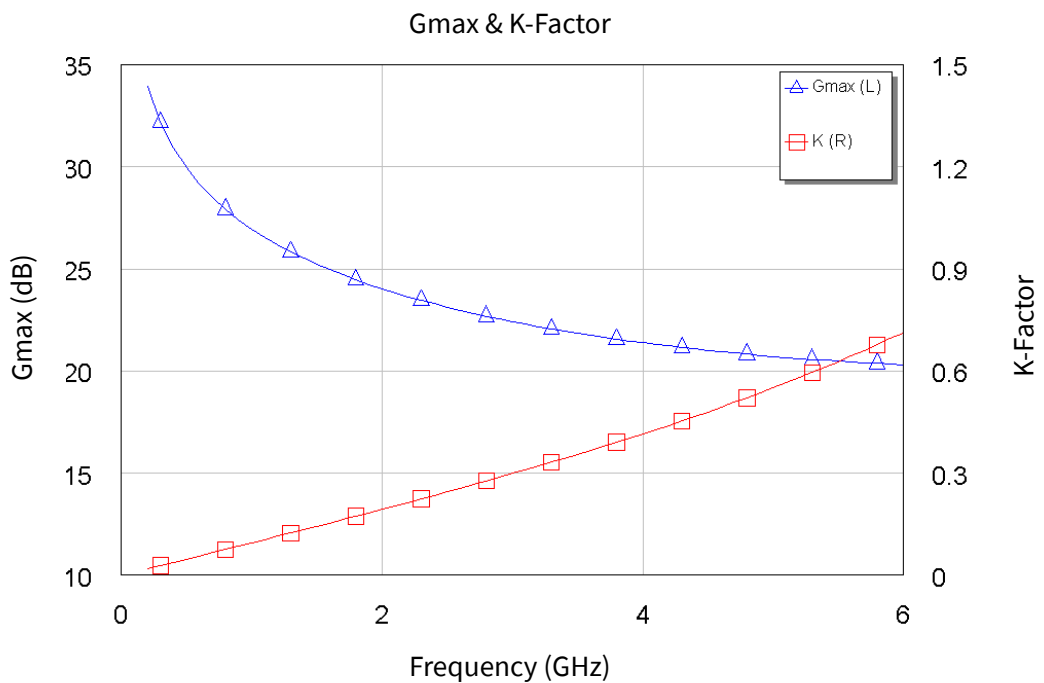


Figure 2. CGHV60040D G_{MAX} and K Factor vs. Frequency at Tcase = 25°C
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 65\text{ mA}$





Typical Die S-Parameters (Small Signal, $V_{DS} = 50\text{ V}$, $I_{DQ} = 65\text{ mA}$, magnitude / angle)

| Frequency | Mag S11 | Ang S11 | Mag S21 | Ang S21 | Mag S12 | Ang S12 | Mag S22 | Ang S22 |
|-----------|---------|---------|---------|---------|---------|---------|---------|---------|
| 0.500 | 0.935 | -124.81 | 17.697 | 105.17 | 0.018 | 16.26 | 0.468 | -61.04 |
| 0.600 | 0.932 | -132.78 | 15.111 | 99.07 | 0.019 | 10.39 | 0.461 | -66.42 |
| 0.700 | 0.930 | -138.77 | 13.108 | 93.98 | 0.019 | 5.52 | 0.462 | -71.19 |
| 0.800 | 0.929 | -143.42 | 11.520 | 89.59 | 0.019 | 1.35 | 0.468 | -75.54 |
| 0.900 | 0.929 | -147.12 | 10.235 | 85.69 | 0.019 | -2.32 | 0.478 | -79.56 |
| 1.000 | 0.929 | -150.12 | 9.175 | 82.18 | 0.019 | -5.62 | 0.491 | -83.30 |
| 1.100 | 0.930 | -152.61 | 8.287 | 78.96 | 0.018 | -8.62 | 0.506 | -86.79 |
| 1.200 | 0.931 | -154.70 | 7.532 | 75.98 | 0.018 | -11.38 | 0.521 | -90.07 |
| 1.300 | 0.932 | -156.49 | 6.884 | 73.19 | 0.018 | -13.94 | 0.537 | -93.16 |
| 1.400 | 0.933 | -158.04 | 6.320 | 70.57 | 0.018 | -16.34 | 0.553 | -96.07 |
| 1.500 | 0.934 | -159.39 | 5.827 | 68.10 | 0.018 | -18.59 | 0.570 | -98.82 |
| 1.600 | 0.936 | -160.58 | 5.391 | 65.75 | 0.017 | -20.72 | 0.586 | -101.42 |
| 1.700 | 0.937 | -161.64 | 5.003 | 63.51 | 0.017 | -22.73 | 0.602 | -103.88 |
| 1.800 | 0.939 | -162.59 | 4.657 | 61.38 | 0.017 | -24.64 | 0.617 | -106.22 |
| 1.900 | 0.940 | -163.45 | 4.346 | 59.35 | 0.016 | -26.45 | 0.633 | -108.45 |
| 2.000 | 0.941 | -164.24 | 4.065 | 57.40 | 0.016 | -28.18 | 0.647 | -110.56 |
| 2.100 | 0.943 | -164.95 | 3.810 | 55.53 | 0.016 | -29.82 | 0.661 | -112.57 |
| 2.200 | 0.944 | -165.61 | 3.579 | 53.73 | 0.016 | -31.39 | 0.675 | -114.49 |
| 2.300 | 0.946 | -166.22 | 3.367 | 52.01 | 0.015 | -32.89 | 0.688 | -116.32 |
| 2.400 | 0.947 | -166.79 | 3.174 | 50.35 | 0.015 | -34.32 | 0.701 | -118.07 |
| 2.500 | 0.948 | -167.32 | 2.996 | 48.75 | 0.015 | -35.70 | 0.713 | -119.74 |
| 2.600 | 0.950 | -167.82 | 2.833 | 47.21 | 0.014 | -37.01 | 0.724 | -121.34 |
| 2.700 | 0.951 | -168.29 | 2.682 | 45.73 | 0.014 | -38.26 | 0.735 | -122.87 |
| 2.800 | 0.952 | -168.73 | 2.542 | 44.29 | 0.014 | -39.47 | 0.745 | -124.33 |
| 2.900 | 0.953 | -169.14 | 2.413 | 42.91 | 0.014 | -40.62 | 0.755 | -125.74 |
| 3.000 | 0.954 | -169.54 | 2.294 | 41.57 | 0.013 | -41.73 | 0.765 | -127.08 |
| 3.200 | 0.957 | -170.27 | 2.079 | 39.03 | 0.013 | -43.81 | 0.782 | -129.62 |
| 3.400 | 0.959 | -170.94 | 1.892 | 36.65 | 0.012 | -45.72 | 0.798 | -131.95 |
| 3.600 | 0.960 | -171.55 | 1.729 | 34.42 | 0.012 | -47.49 | 0.812 | -134.12 |
| 3.800 | 0.962 | -172.11 | 1.585 | 32.31 | 0.011 | -49.12 | 0.825 | -136.13 |
| 4.000 | 0.964 | -172.64 | 1.458 | 30.33 | 0.011 | -50.63 | 0.837 | -137.99 |
| 4.200 | 0.965 | -173.13 | 1.346 | 28.45 | 0.010 | -52.03 | 0.848 | -139.73 |
| 4.400 | 0.966 | -173.59 | 1.246 | 26.67 | 0.010 | -53.32 | 0.857 | -141.35 |
| 4.600 | 0.967 | -174.02 | 1.156 | 24.99 | 0.009 | -54.51 | 0.866 | -142.87 |
| 4.800 | 0.969 | -174.43 | 1.076 | 23.38 | 0.009 | -55.62 | 0.874 | -144.29 |
| 5.000 | 0.970 | -174.82 | 1.004 | 21.85 | 0.009 | -56.64 | 0.882 | -145.63 |
| 5.200 | 0.970 | -175.19 | 0.939 | 20.39 | 0.008 | -57.59 | 0.888 | -146.88 |
| 5.400 | 0.971 | -175.54 | 0.880 | 19.00 | 0.008 | -58.46 | 0.894 | -148.07 |
| 5.600 | 0.972 | -175.88 | 0.826 | 17.66 | 0.008 | -59.27 | 0.900 | -149.18 |
| 5.800 | 0.973 | -176.20 | 0.777 | 16.37 | 0.007 | -60.01 | 0.905 | -150.24 |
| 6.000 | 0.973 | -176.51 | 0.732 | 15.14 | 0.007 | -60.69 | 0.910 | -151.24 |

To download the s-parameters in s2p format, go to the [CGHV60040D](#) Product Page and click on the documentation tab.



Part Number System

CGHV60040D



Table 1.

| Parameter | Value | Units |
|------------------------------|----------|-------|
| Upper Frequency ¹ | 6.0 | GHz |
| Power Output | 40 | W |
| Package | Bare Die | - |

Note¹: Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

Table 2.

| Character Code | Code Value |
|----------------|--------------------------------|
| A | 0 |
| B | 1 |
| C | 2 |
| D | 3 |
| E | 4 |
| F | 5 |
| G | 6 |
| H | 7 |
| J | 8 |
| K | 9 |
| Examples: | 1A = 10.0 GHz 2H = 27.0 GHz |

CGHV60040D



Product Ordering Information

| Order Number | Description | Unit of Measure |
|--------------|-------------|-----------------|
| CGHV60040D | GaN HEMT | Each |



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Notes

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[CGHV1J006D](#) [CGHV27030S](#) [CGHV27060MP](#)