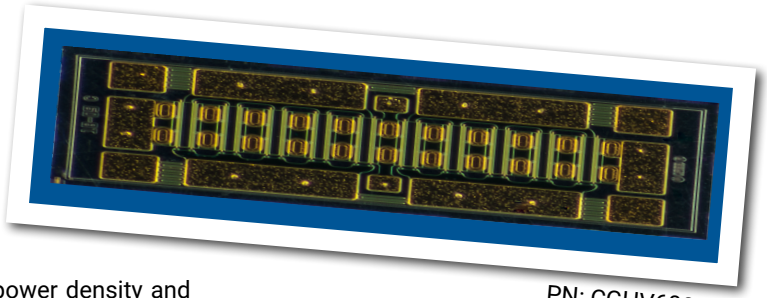
CGHV60040D

40 W, 6.0 GHz, GaN HEMT Die



PN: CGHV60040D

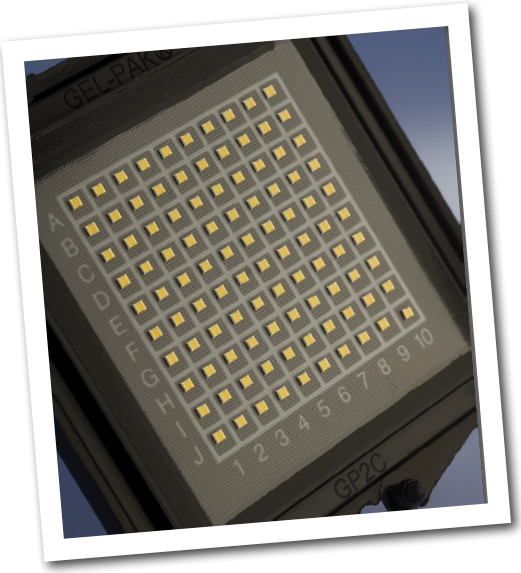
Cree's CGHV60040D is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT). GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity, and higher thermal conductivity. GaN HEMTs offer greater power density and wider bandwidths compared to Si and GaAs transistors.

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 AB, Linear amplifiers suitable for OFDM, W-CDMA, LTE, EDGE, CDMA waveforms



Packaging Information

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

Large Signal Models Available for ADS and MWO

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

Note[1] Current limit for long term reliable operation.

Note[2] 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˚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 V, I_D = 5.2 mA
Drain Current[1]	I_{DSS}	4.2	5.2	–	A	V_{DS} = 6 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BD}	150	–	–	V	V_{GS} = -8 V, I_D = 5.2 mA
On Resistance	R_{ON}	–	0.56	–	Ω	V_{DS} = 0.1 V
Gate Forward Voltage	V_{G-ON}	–	1.9	–	V	I_{GS} = 5.2 mA
RF Characteristics						
Small Signal Gain	G_{SS}	–	17	–	dB	V_{DD} = 50 V, I_{DQ} = 65 mA
Saturated Power Output[2,3]	P_{SAT}	–	40	–	W	V_{DD} = 50 V, I_{DQ} = 65 mA
Drain Efficiency[4]	η	–	65	–	%	V_{DD} = 50 V, I_{DQ} = 65 mA, P_{SAT} = 40 W
Intermodulation Distortion	IM3	–	-30	–	dBc	V_{DD} = 50 V, I_{DQ} = 65 mA, P_{OUT} = 40 W PEP
Output Mismatch Stress	VSWR	–	–	10 : 1	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 65 mA P_{OUT} = 40 W CW
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	7.1	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	1.6	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	0.15	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz

Notes:

[1] Scaled from PCM data

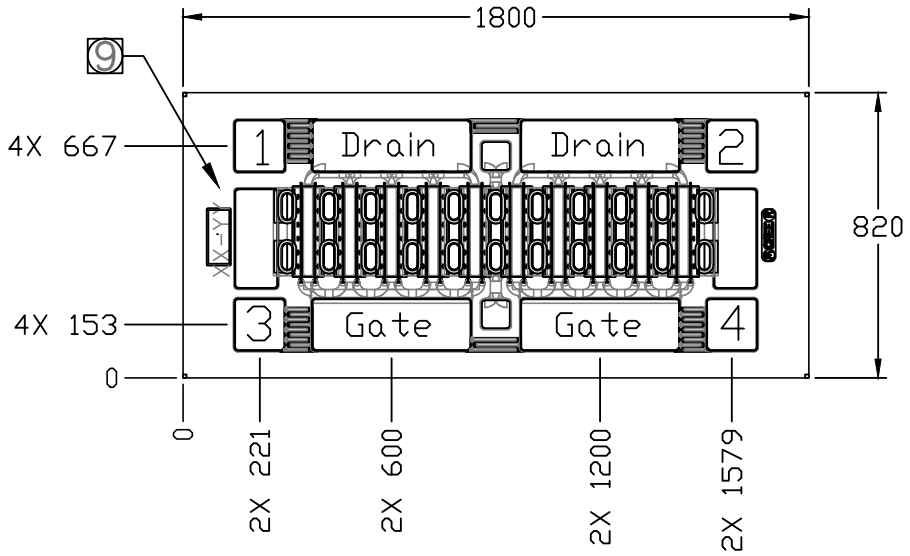
[2] P_{SAT} is defined as I_G = 0.52 mA.

[3] Pulsed 100 µsec, 10%

[4] Drain Efficiency = P_{OUT} / P_{DC}

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

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.

Assembly Notes:

- Recommended solder is AuSn (80/20) solder. Refer to Cree's website for the Eutectic Die Bond Procedure application note at www.cree.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, see arrow 9 in the drawing above.

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Typical Performance

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

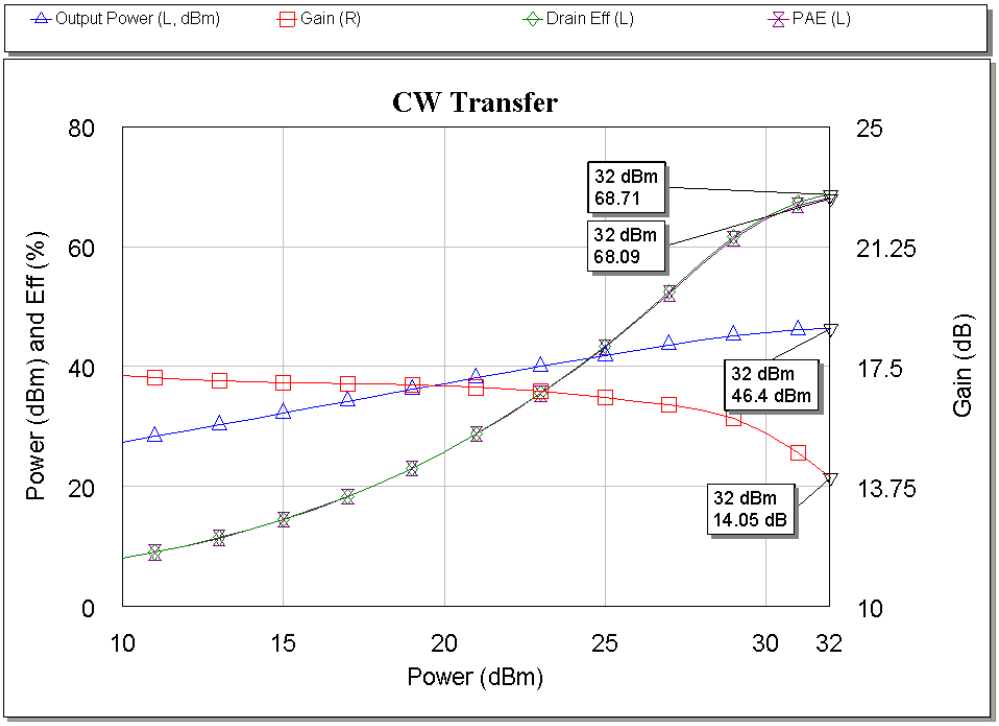
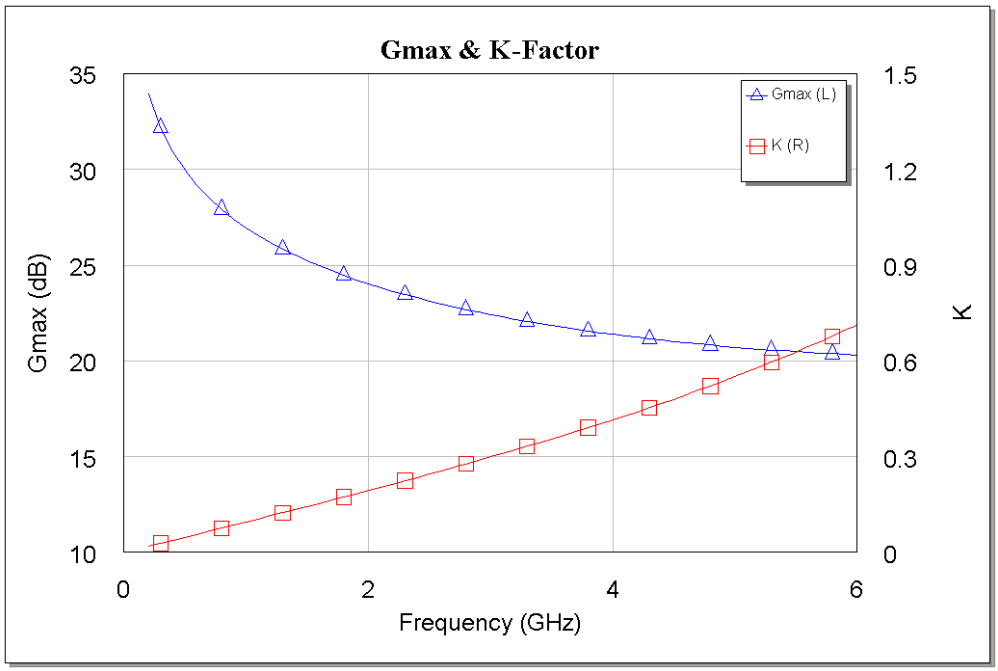


Figure 2. - CGHV60040D G_{MAX} and K Factor vs. Frequency at Tcase = 25°C
V_{DD} = 50 V, I_{DQ} = 65 mA



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Typical Die S-Parameters (Small Signal, V_{DS} = 50 V, I_{DQ} = 65 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 the documentation tab.

Cree, Inc.
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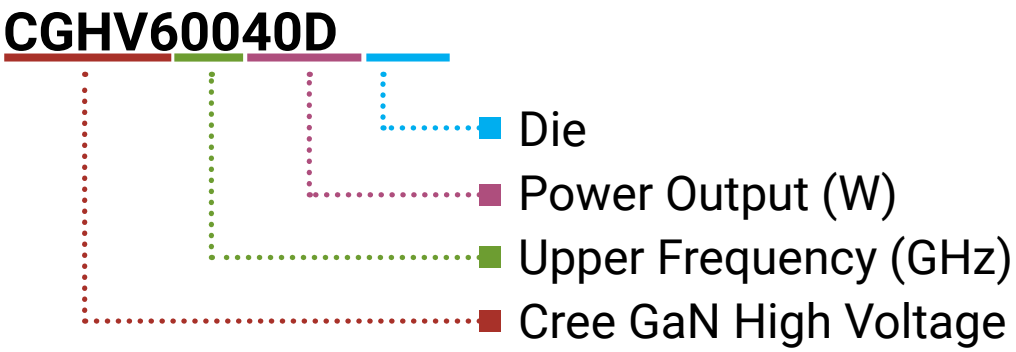
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
www.cree.com/rf

Part Number System



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

Table 1.

Note[1]: Alpha characters used in frequency code indicate a value greater than 9.9 GHz. See Table 2 for value.

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

Table 2.

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4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
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Product Ordering Information

Order Number	Description	Unit of Measure
CGHV60040D	GaN HEMT	Each
CGHV60040D-TB	Test board without GaN HEMT	Each
CGHV60040D-AMP1	Test board with GaN HEMT installed	Each

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For more information, please contact:

Cree, Inc.
4600 Silicon Drive
Durham, NC 27703
www.cree.com/rf

Sarah Miller
Marketing
Cree, RF Components
1.919.407.5302

Ryan Baker
Marketing & Sales
Cree, RF Components
1.919.407.7816

Tom Dekker
Sales Director
Cree, RF Components
1.919.407.5639

Cree, Inc.
4600 Silicon Drive
Durham, North Carolina, USA 27703
USA Tel: +1.919.313.5300
Fax: +1.919.869.2733
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