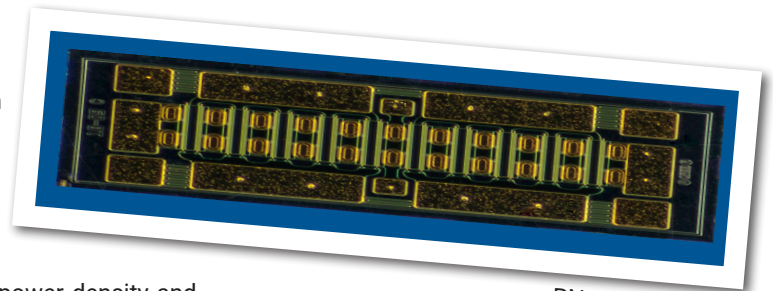


CGHV60040D

40 W, 6.0 GHz, GaN HEMT Die

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

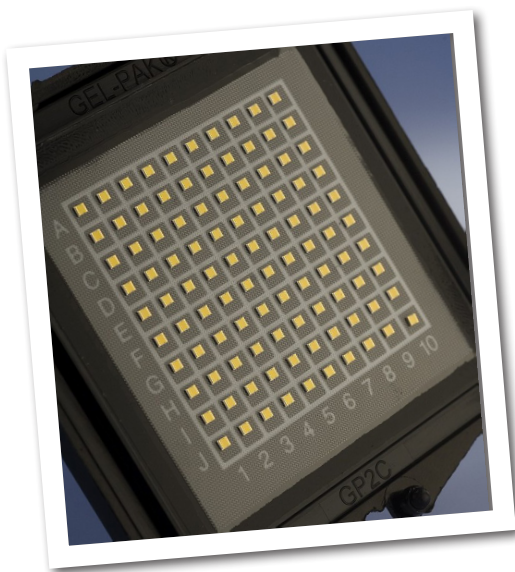
- 18 dB Typical Small Signal Gain at 4 GHz
- 17 dB Typical Small Signal Gain at 6 GHz
- 65% Typical Power Added Efficiency
- 40 W Typical P_{SAT}
- 50 V Operation
- High Breakdown Voltage
- Up to 6 GHz Operation

APPLICATIONS

- Cellular Infrastructure
- Class 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_{DS}	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

Note¹ Current limit for long term reliable operation.

Note² 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}	150	-	-	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:

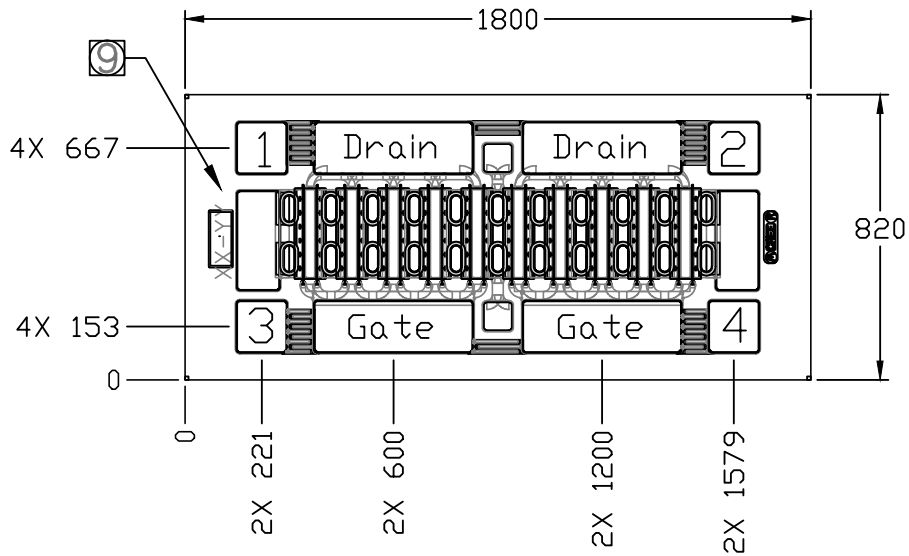
¹ Scaled from PCM data

² 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 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.

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

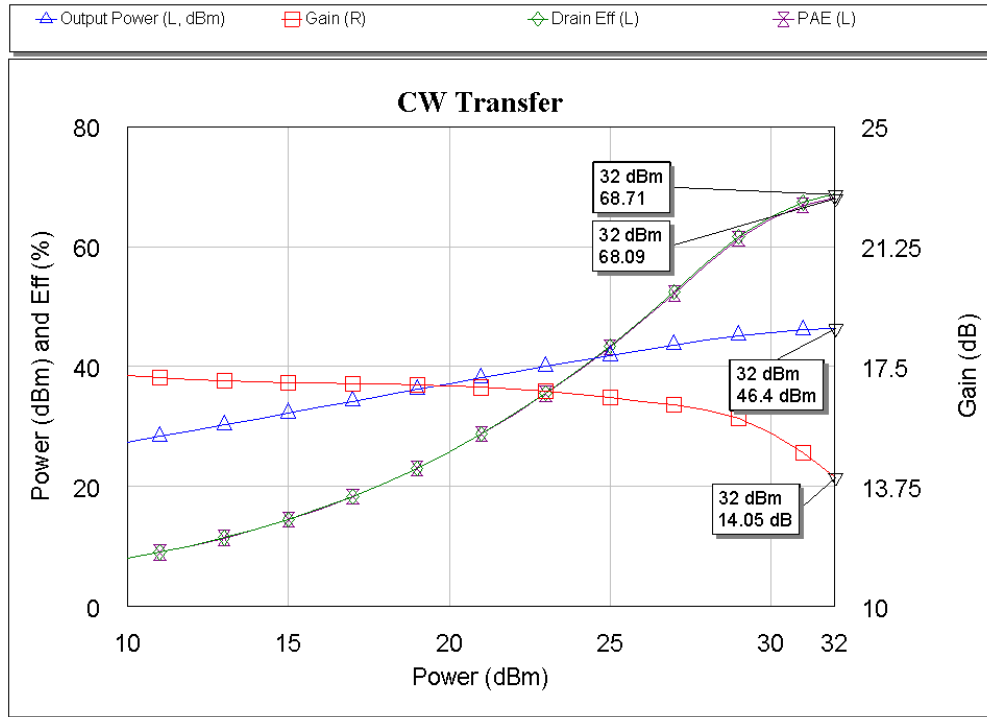
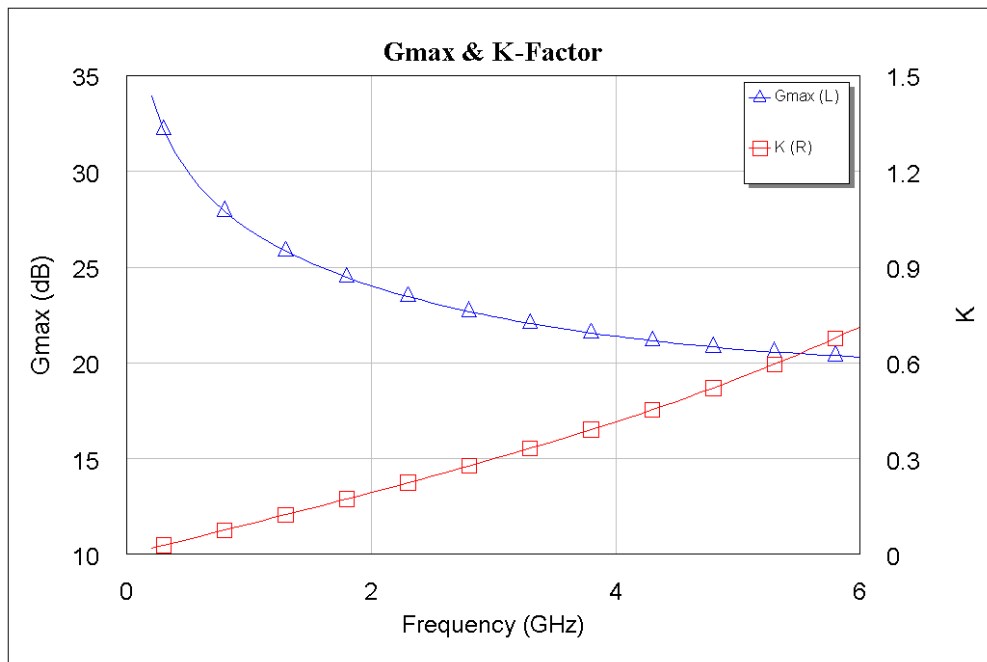


Figure 2. - CGHV60040D G_{MAX} and K Factor vs. Frequency at Tcase = 25°C
 $V_{DD} = 50\text{ V}$, $I_{DQ} = 65\text{ mA}$



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 the documentation tab.

Part Number System

CGHV60040D



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

Table 1.

Note¹: 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.

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



Disclaimer

Specifications are subject to change without notice. Cree, Inc. believes the information contained within this data sheet to be accurate and reliable. However, no responsibility is assumed by Cree for its use or for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Cree. Cree makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose. "Typical" parameters are the average values expected by Cree in large quantities and are provided for information purposes only. These values can and do vary in different applications, and actual performance can vary over time. All operating parameters should be validated by customer's technical experts for each application. Cree products are not designed, intended, or authorized for use as components in applications intended for surgical implant into the body or to support or sustain life, in applications in which the failure of the Cree product could result in personal injury or death, or in applications for the planning, construction, maintenance or direct operation of a nuclear facility. CREE and the CREE logo are registered trademarks of Cree, Inc.

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