

# CGHV60040D

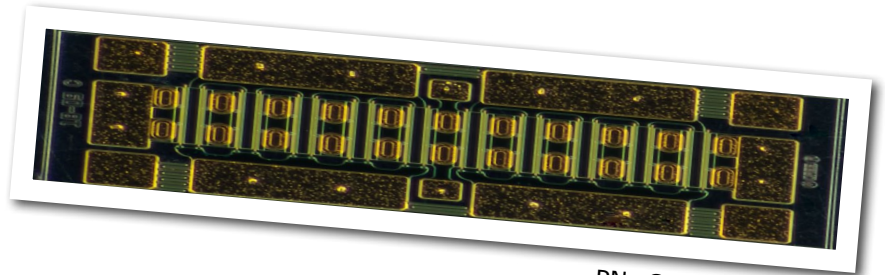
## 40 W, 6.0 GHz, GaN HEMT Die

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.



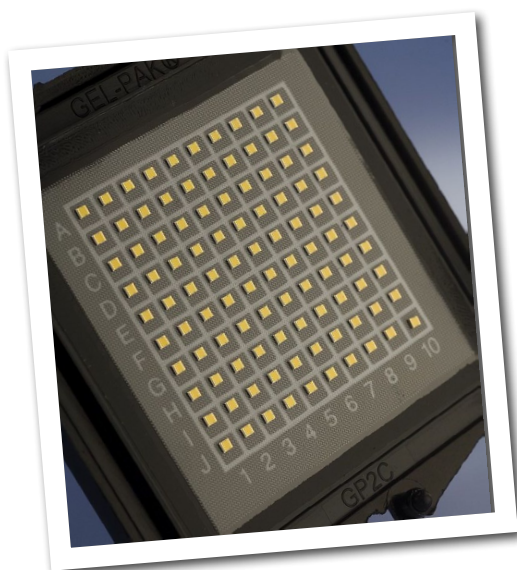
PN: CGHV60040D

### 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.

## 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 <sup>1</sup>	$I_{MAX}$	3.2	A	25°C
Maximum Forward Gate Current	$I_{GMAX}$	5.2	mA	25°C
Thermal Resistance, Junction to Case (packaged) <sup>2</sup>	$R_{\theta JC}$	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<sup>1</sup> Current limit for long term reliable operation.

Note<sup>2</sup> Eutectic die attach using 80/20 AuSn mounted to a 10 mil thick Cu15Mo85 carrier.

## Electrical Characteristics (Frequency = 6 GHz unless otherwise stated; $T_C = 25^\circ C$ )

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics</b>						
Gate Pinch-Off Voltage	$V_P$	-3.8	-3.0	-2.3	V	$V_{DS} = 10 V, I_D = 5.2 mA$
Drain Current <sup>1</sup>	$I_{DSS}$	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	-	$\Omega$	$V_{DS} = 0.1 V$
Gate Forward Voltage	$V_{G-ON}$	-	1.9	-	V	$I_{GS} = 5.2 mA$
<b>RF Characteristics</b>						
Small Signal Gain	$G_{SS}$	-	17	-	dB	$V_{DD} = 50 V, I_{DQ} = 65 mA$
Saturated Power Output <sup>2,3</sup>	$P_{SAT}$	-	40	-	W	$V_{DD} = 50 V, I_{DQ} = 65 mA$
Drain Efficiency <sup>4</sup>	$\eta$	-	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	$\Psi$	No damage at all phase angles, $V_{DD} = 50 V, I_{DQ} = 65 mA$ $P_{OUT} = 40 W CW$
<b>Dynamic Characteristics</b>						
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:

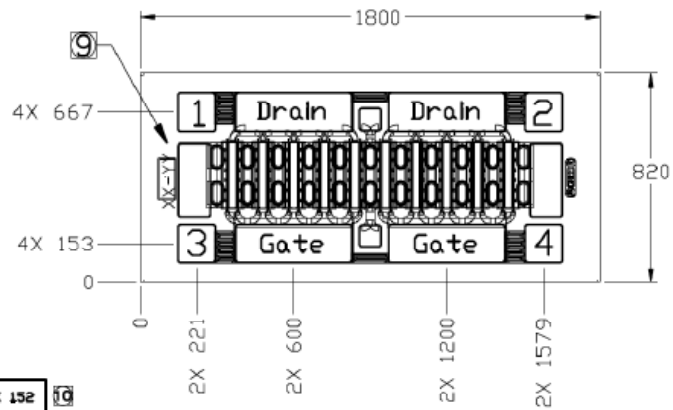
<sup>1</sup> Scaled from PCM data



<sup>2</sup>  $P_{SAT}$  is defined as  $I_G = 0.52 mA$ .

<sup>3</sup> Pulsed 100  $\mu sec$ , 10%

<sup>4</sup> Drain Efficiency =  $P_{OUT} / P_{DC}$

## DIE DIMENSIONS (units in microns)



BOND PAD 1, 2	DRAIN INTERCONNECT	156 X 152	
BOND PAD 3, 4	GATE INTERCONNECT	156 X 152	
2X DRAIN PAD		464 X 156	
2X GATE PAD		464 X 156	

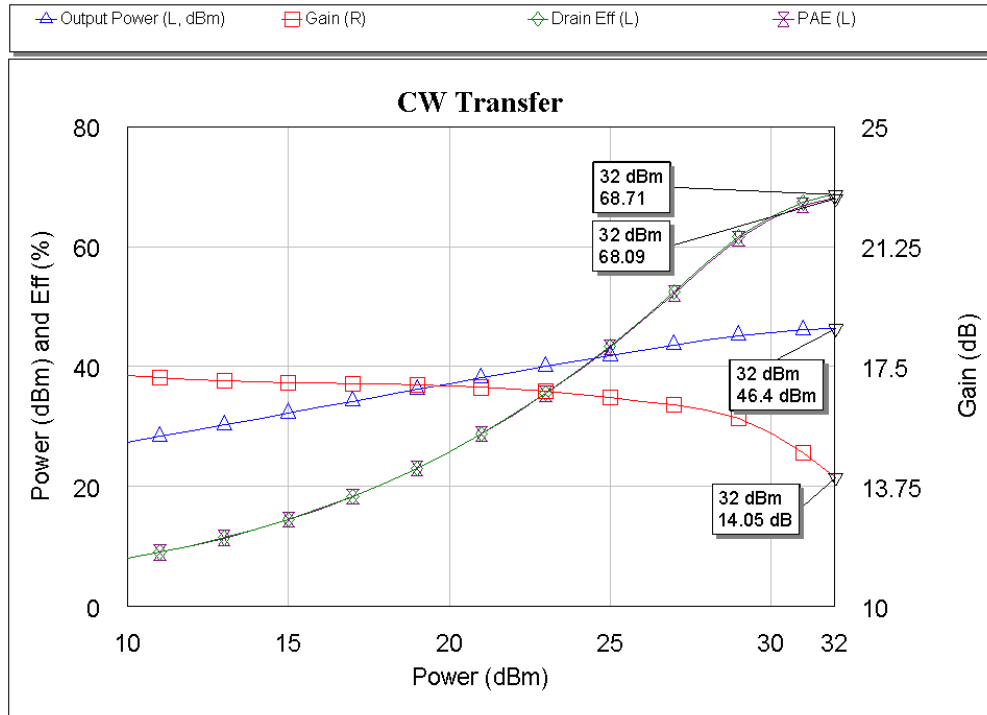
Overall die size 820 x 1800 (+0/-50) microns, die thickness 100 microns.  
All Gate and Drain pads must be wire bonded for electrical connection.

### Assembly Notes:

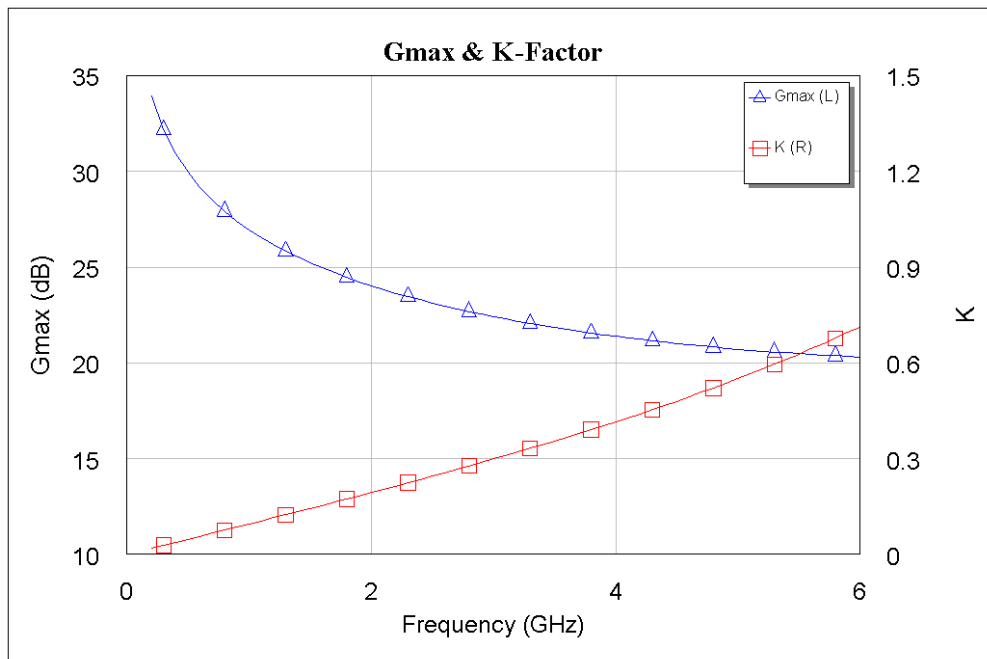
- Recommended solder is AuSn (80/20) solder. Refer to Cree's website for the Eutectic Die Bond Procedure application note at [www.cree.com/wireless](http://www.cree.com/wireless).
- Vacuum collet is the preferred method of pick-up.
- The backside of the die is the Source (ground) contact.
- Die back 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**  
 $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 65\text{ mA}$



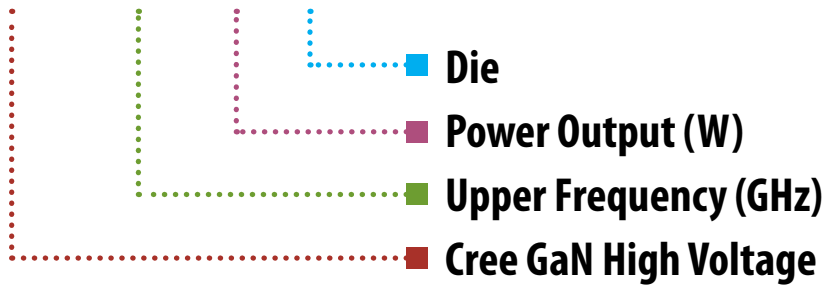
### Typical Die S-Parameters (Small Signal, $V_{DS} = 50\text{ V}$ , $I_{DQ} = 65\text{ mA}$ , magnitude / angle)

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 <sup>1</sup>	6.0	GHz
Power Output	40	W
Package	Bare Die	-

**Table 1.**

**Note<sup>1</sup>:** 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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