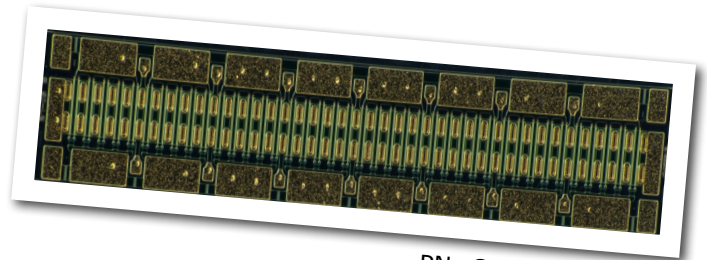


# CGHV60170D

## 170 W, 6.0 GHz, 50V GaN HEMT Die

Cree's CGHV60170D 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: CGHV60170D

### FEATURES

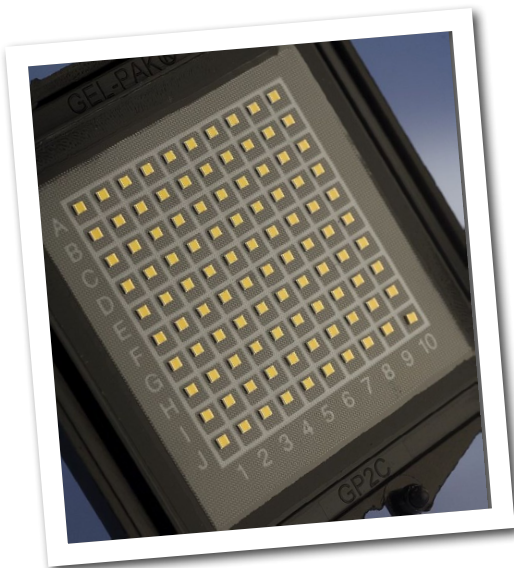
- 18 dB Typical Small Signal Gain at 4 GHz
- 17 dB Typical Small Signal Gain at 6 GHz
- 65% Typical Power Added Efficiency
- 170 W Typical  $P_{SAT}$
- 50 V Operation
- High Breakdown Voltage
- Up to 6 GHz Operation

### APPLICATIONS

- Broadband amplifiers
- Tactical communications
- Satellite communications
- Industrial, Scientific, and Medical amplifiers
- 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	$V_{DSS}$	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 <sup>1</sup>	$I_{MAX}$	12.6	A	25 °C
Maximum Forward Gate Current	$I_{GMAX}$	20.8	mA	25 °C
Thermal Resistance, Junction to Case (packaged) <sup>2</sup>	$R_{\theta JC}$	1.36	°C/W	85 °C, 83.2W Dissipation
Thermal Resistance, Junction to Case (die only)	$R_{\theta JC}$	0.83	°C/W	85 °C, 83.2W 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	$V_{DS} = 10 V, I_D = 20.8 mA$
Drain Current <sup>1</sup>	$I_{DSS}$	16.8	20.8	-	A	$V_{DS} = 6 V, V_{GS} = 2.0 V$
Drain-Source Breakdown Voltage	$V_{BD}$	150	-	-	V	$V_{GS} = -8 V, I_D = 20.8 mA$
On Resistance	$R_{ON}$	-	0.14	-	$\Omega$	$V_{DS} = 0.1 V$
Gate Forward Voltage	$V_{G-ON}$	-	1.9	-	V	$I_{GS} = 20.8 mA$
<b>RF Characteristics</b>						
Small Signal Gain	$G_{SS}$	-	17	-	dB	$V_{DD} = 50 V, I_{DQ} = 260 mA$
Saturated Power Output <sup>2,3</sup>	$P_{SAT}$	-	170	-	W	$V_{DD} = 50 V, I_{DQ} = 260 mA$
Drain Efficiency <sup>4</sup>	$\eta$	-	65	-	%	$V_{DD} = 50 V, I_{DQ} = 260 mA, P_{SAT} = 170 W$
Intermodulation Distortion	IM3	-	-30	-	dBc	$V_{DD} = 50 V, I_{DQ} = 260 mA, P_{OUT} = 170 W PEP$
Output Mismatch Stress	VSWR	-	-	10 : 1	$\Psi$	No damage at all phase angles, $V_{DD} = 50 V, I_{DQ} = 260 mA$ $P_{OUT} = 170 W CW$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{GS}$	-	28.3	-	pF	$V_{DS} = 50 V, V_{GS} = -8 V, f = 1 MHz$
Output Capacitance	$C_{DS}$	-	6.35	-	pF	$V_{DS} = 50 V, V_{GS} = -8 V, f = 1 MHz$
Feedback Capacitance	$C_{GD}$	-	0.6	-	pF	$V_{DS} = 50 V, V_{GS} = -8 V, f = 1 MHz$

### Notes:

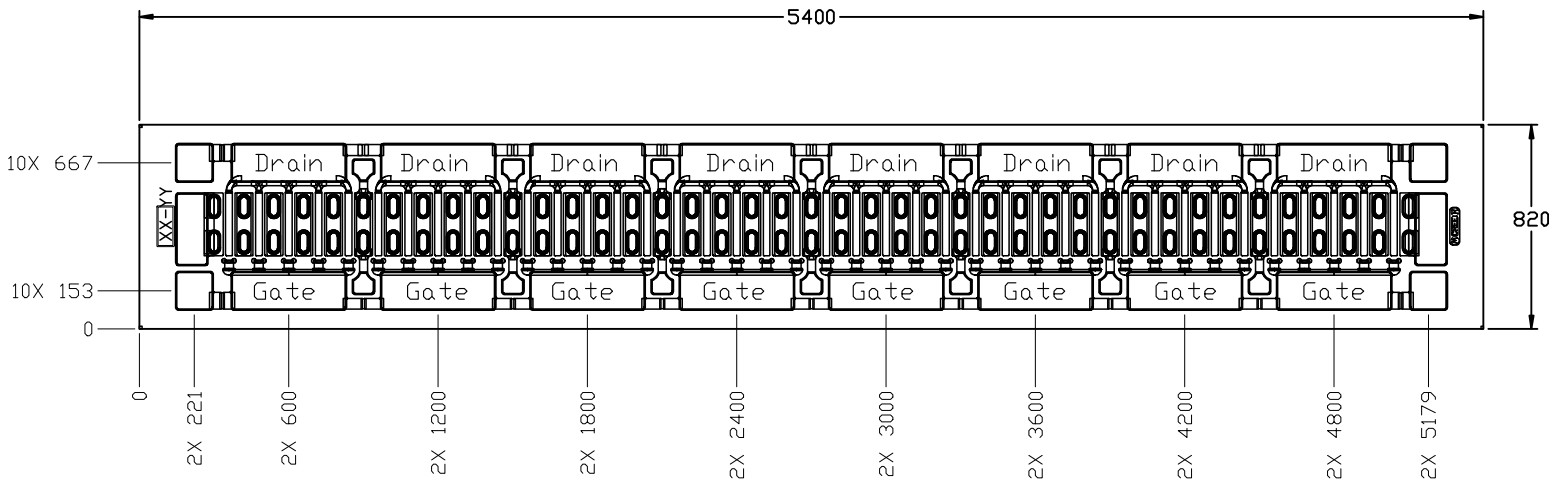
<sup>1</sup> Scaled from PCM data

<sup>2</sup>  $P_{SAT}$  is defined as  $I_G = 2.0 mA$ .

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

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

## DIE Dimensions (units in microns)



Overall die size 820 x 5400 (+0/-50) microns, die thickness 100 microns.  
All Gate and Drain pads must be wire bonded for electrical connection.

### Assembly Notes:

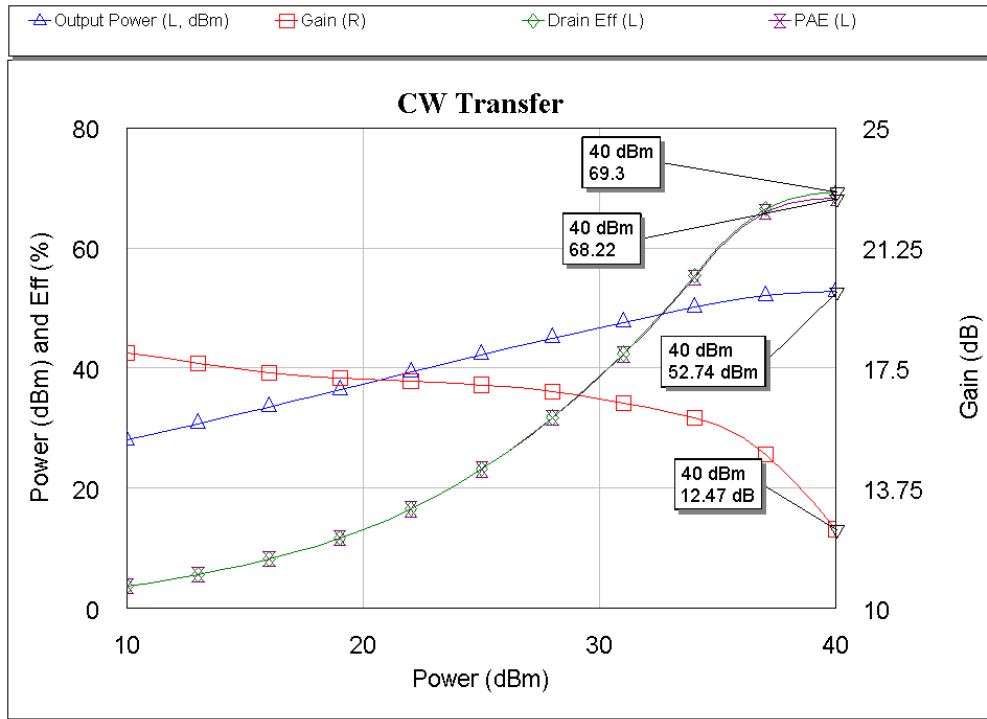
- Recommended solder is AuSn (80/20) solder. Refer to Cree's website for the Eutectic Die Bond Procedure application note at [www.cree.com/RF](http://www.cree.com/RF).
- Vacuum collet is the preferred method of pick-up.
- The backside of the die is the Source (ground) contact.
- Die back side gold plating 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.

## Electrostatic Discharge (ESD) Classifications

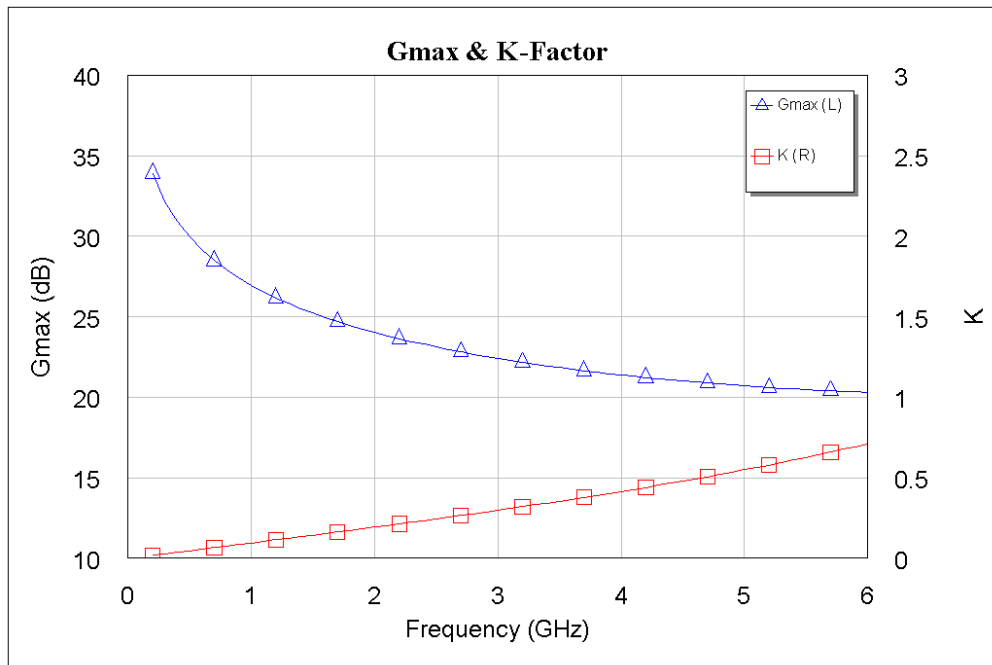
Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	2 (125 V to 250 V)	JEDEC JESD22 C101-C

## Typical Performance

**Figure 1. - CGHV60170D Output Power, Gain and Efficiency vs. Input Power at Tcase = 25°C**  
 $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 260\text{ mA}$ , Frequency = 2.7 GHz



**Figure 2. - CGHV60170D  $G_{MAX}$  and K Factor vs. Frequency at Tcase = 25°C**  
 $V_{DD} = 50\text{ V}$ ,  $I_{DQ} = 260\text{ mA}$



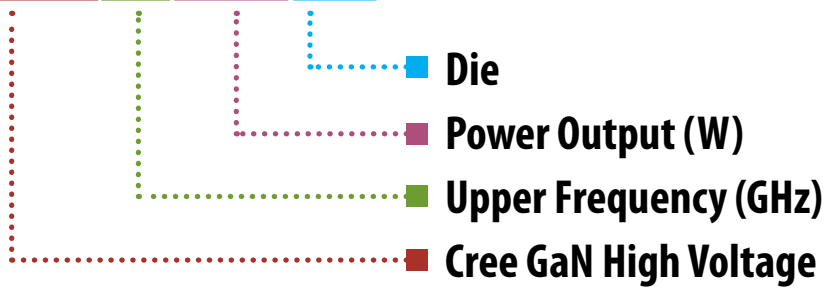
## Typical Die S-Parameters (Small Signal, $V_{DS} = 50\text{ V}$ , $I_{DQ} = 260\text{ mA}$ , magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
0.5	0.943	-168.72	9.039	75.28	0.009	-13.64	0.544	-156.15
0.6	0.946	-170.27	7.375	70.86	0.009	-17.83	0.571	-155.58
0.7	0.948	-171.36	6.170	66.84	0.009	-21.63	0.600	-155.23
0.8	0.951	-172.18	5.255	63.13	0.009	-25.12	0.627	-155.11
0.9	0.953	-172.81	4.538	59.69	0.008	-28.34	0.654	-155.19
1	0.956	-173.33	3.961	56.48	0.008	-31.32	0.680	-155.45
1.1	0.959	-173.76	3.488	53.50	0.008	-34.08	0.704	-155.84
1.2	0.961	-174.13	3.095	50.72	0.008	-36.64	0.726	-156.32
1.3	0.963	-174.45	2.764	48.12	0.007	-39.02	0.747	-156.87
1.4	0.966	-174.73	2.482	45.69	0.007	-41.22	0.766	-157.45
1.5	0.968	-174.99	2.239	43.42	0.007	-43.27	0.783	-158.07
1.6	0.970	-175.23	2.030	41.30	0.007	-45.17	0.799	-158.69
1.7	0.971	-175.44	1.848	39.31	0.006	-46.94	0.814	-159.31
1.8	0.973	-175.64	1.688	37.44	0.006	-48.59	0.827	-159.93
1.9	0.974	-175.83	1.548	35.68	0.006	-50.12	0.839	-160.53
2	0.976	-176.00	1.424	34.02	0.006	-51.55	0.850	-161.11
2.1	0.977	-176.17	1.314	32.47	0.005	-52.88	0.860	-161.68
2.2	0.978	-176.32	1.216	31.00	0.005	-54.13	0.869	-162.23
2.3	0.979	-176.46	1.128	29.60	0.005	-55.30	0.877	-162.76
2.4	0.980	-176.60	1.049	28.29	0.005	-56.39	0.885	-163.27
2.5	0.981	-176.73	0.977	27.04	0.005	-57.41	0.892	-163.75
2.6	0.982	-176.85	0.913	25.85	0.005	-58.37	0.898	-164.22
2.7	0.983	-176.97	0.855	24.72	0.004	-59.27	0.904	-164.67
2.8	0.984	-177.08	0.802	23.65	0.004	-60.11	0.909	-165.09
2.9	0.984	-177.18	0.753	22.63	0.004	-60.91	0.914	-165.50
3	0.985	-177.29	0.709	21.65	0.004	-61.66	0.919	-165.90
3.2	0.986	-177.47	0.631	19.82	0.004	-63.03	0.927	-166.63
3.4	0.987	-177.65	0.566	18.13	0.004	-64.25	0.934	-167.31
3.6	0.988	-177.81	0.510	16.57	0.003	-65.34	0.940	-167.93
3.8	0.989	-177.95	0.462	15.12	0.003	-66.31	0.945	-168.50
4	0.989	-178.09	0.420	13.78	0.003	-67.19	0.950	-169.02
4.2	0.990	-178.22	0.384	12.51	0.003	-67.97	0.954	-169.51
4.4	0.991	-178.34	0.352	11.32	0.003	-68.67	0.958	-169.96
4.6	0.991	-178.45	0.324	10.20	0.003	-69.30	0.961	-170.38
4.8	0.991	-178.56	0.299	9.14	0.002	-69.86	0.964	-170.77
5	0.992	-178.66	0.277	8.13	0.002	-70.36	0.966	-171.14
5.2	0.992	-178.76	0.258	7.18	0.002	-70.81	0.968	-171.48
5.4	0.992	-178.85	0.240	6.26	0.002	-71.20	0.970	-171.80
5.6	0.993	-178.94	0.224	5.38	0.002	-71.55	0.972	-172.10
5.8	0.993	-179.02	0.210	4.54	0.002	-71.85	0.974	-172.38
6	0.993	-179.10	0.197	3.73	0.002	-72.10	0.975	-172.65

To download the s-parameters in s2p format, go to the [CGHV60170D Product Page](#) and click the documentation tab.

## Part Number System

### CGHV60170D



Parameter	Value	Units
Upper Frequency <sup>1</sup>	6.0	GHz
Power Output	170	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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