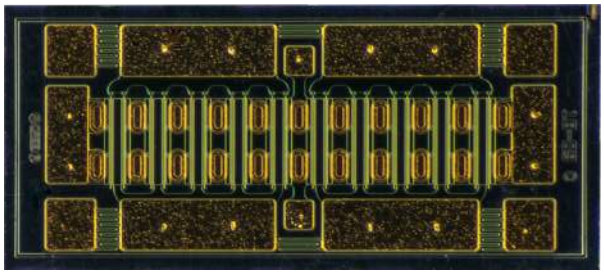
CGHV60040D

40 W, 6.0 GHz, GaN HEMT Die



PN: CGHV60040D

Description

Wolfspeed'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 A, AB, Linear amplifiers suitable for OFDM, W-CDMA, 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

4600 Silicon Drive | Durham, NC 27703 | Tel: +1.919.313.5300

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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		
Storage Temperature	T_{STG}	-65, +150	°C	
Operating Junction Temperature	T_J	225		
Maximum Drain Current[1]	I_{DMAX}	3.2	A	25°C
Maximum Forward Gate Current	I_{GMAX}	5.2	mA	
Thermal Resistance, Junction to Case (packaged)[2]	$R_{\theta JC}$	5.10	°C/W	85°C, 20.8 W Dissipation
Thermal Resistance, Junction to Case (die only)		3.27		
Mounting Temperature	T_s	320	°C	30 seconds

Notes:
[1] Current limit for long term, reliable operation
[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_{BR}	125	—	—	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	
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	—		
Feedback Capacitance	C_{GD}	—	0.15	—		

Notes:
[1] Scaled from PCM data
[2] P_{SAT} is defined as I_G = 0.52 mA
[1] Pulsed 100µsec, 10%
[3] Drain Efficiency = P_{OUT} / P_{DC}

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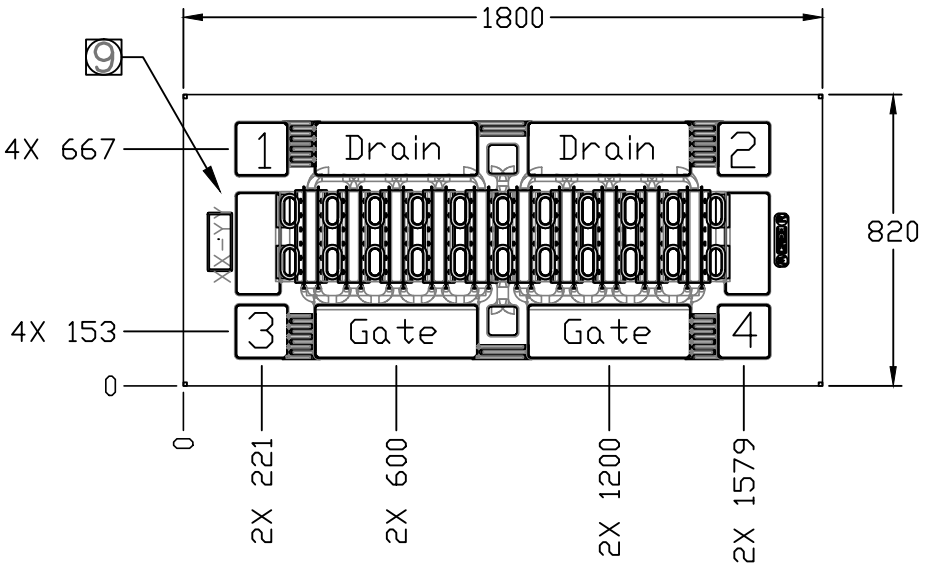
DIE Dimensions (units in microns)



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

Overall die size 1800 x 820 (+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 Wolfspeed's website for the Eutectic Die Bond Procedure application note at https://www.wolfspeed.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.

Electrostatic Discharge (ESD) Classifications

Parameter	Symbol	Class	Classification Level	Test Methodology
Human Body Model	HBM	TBD	ANSI/ESDA/JEDEC JS-001 Table 3	JEDEC JESD22 A114-D

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Typical Performance

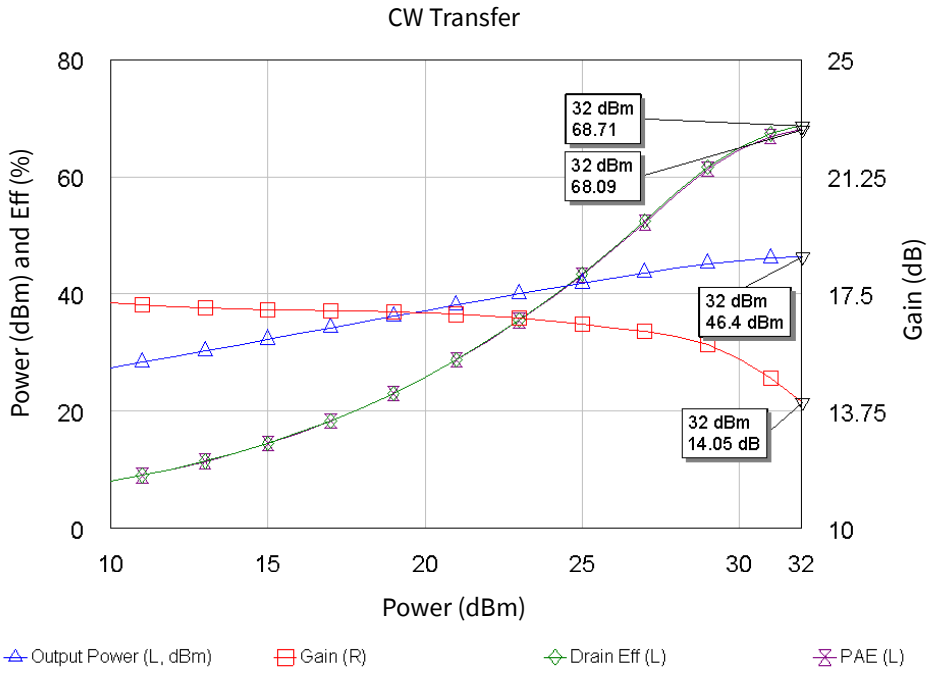

Figure 1. CGHV60040D Output Power, Gain and Efficiency vs Input Power at T_{CASE} = 25°C
V_{DD} = 50 V, I_{DQ} = 65 mA, Frequency = 2.7 GHz

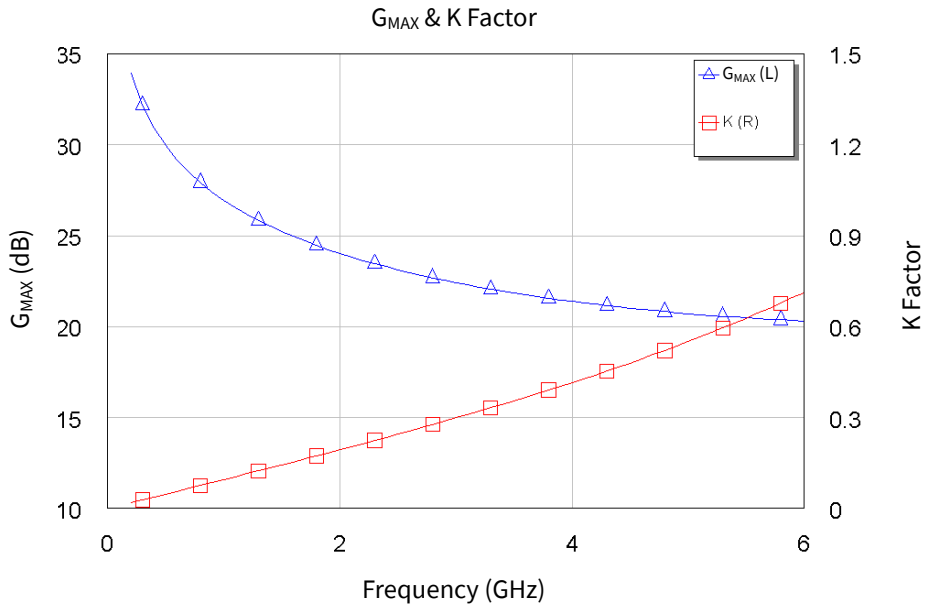

Figure 2. CGHV60040D G_{MAX} and K Factor vs. Frequency at T_{CASE} = 25°C
V_{DD} = 50 V, I_{DQ} = 500 mA

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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 CGHV40320D Product page and click on the documentation tab.

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Part Number System

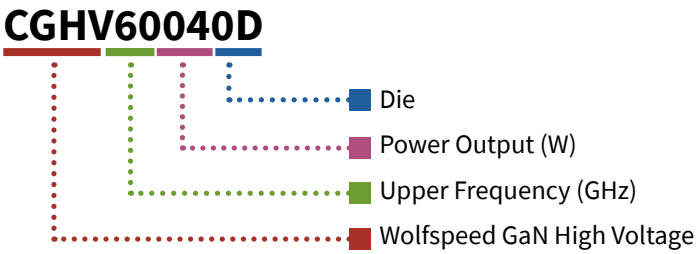

Table 1.

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

Note:
[1] 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

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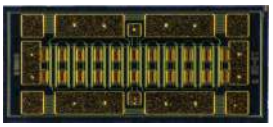
Product Ordering Information

Order Number	Description	Unit of Measure	Image
CGHV60040D	GaN HEMT	Each	

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