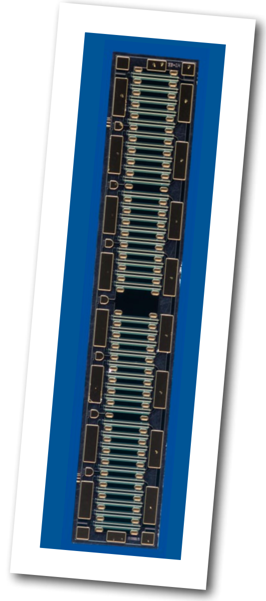
CGHV40320D

320 W, 4.0 GHz, GaN HEMT Die

Cree's CGHV40320D 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.

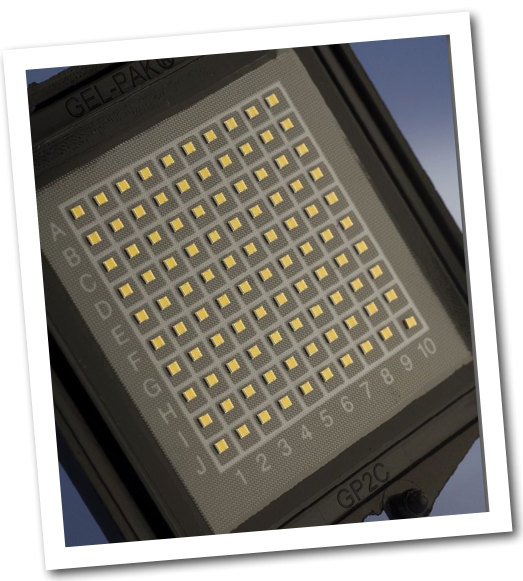


FEATURES

- 19 dB Typical Small Signal Gain at 4 GHz
- 65% Typical Power Added Efficiency
- 320 W Typical P_{SAT}
- 50 V Operation
- High Breakdown Voltage
- Up to 4 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[1]	I_{MAX}	12	A	25˚C
Maximum Forward Gate Current	I_{GMAX}	41.8	mA	25˚C
Thermal Resistance, Junction to Case (packaged)[2]	$R_{\theta JC}$	0.44	˚C/W	85˚C, 167.2W Dissipation
Thermal Resistance, Junction to Case (die only)	$R_{\theta JC}$	0.35	˚C/W	85˚C, 167.2W 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 = 4 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 = 41.8 mA
Drain Current[1]	I_{DSS}	33	41.8	–	A	V_{DS} = 6 V, V_{GS} = 2.0 V
Drain-Source Breakdown Voltage	V_{BD}	150	–	–	V	V_{GS} = -8 V, I_D = 41.8 mA
On Resistance	R_{ON}	–	0.07	–	Ω	V_{DS} = 0.1 V
Gate Forward Voltage	V_{G-ON}	–	1.9	–	V	I_{GS} = 41.8 mA
RF Characteristics						
Small Signal Gain	G_{SS}	–	19	–	dB	V_{DD} = 50 V, I_{DQ} = 500 mA
Saturated Power Output[2]	P_{SAT}	–	320	–	W	V_{DD} = 50 V, I_{DQ} = 500 mA
Drain Efficiency[3]	η	–	65	–	%	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{SAT} = 320 W
Intermodulation Distortion	IM3	–	-30	–	dBc	V_{DD} = 50 V, I_{DQ} = 500 mA, P_{OUT} = 320 W PEP
Output Mismatch Stress	VSWR	–	–	10 : 1	Ψ	No damage at all phase angles, V_{DD} = 50 V, I_{DQ} = 500 mA, P_{OUT} = 320 W Pulsed
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	55.6	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Output Capacitance	C_{DS}	–	11.56	–	pF	V_{DS} = 50 V, V_{gs} = -8 V, f = 1 MHz
Feedback Capacitance	C_{GD}	–	1.23	–	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 = 4.0 mA.

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

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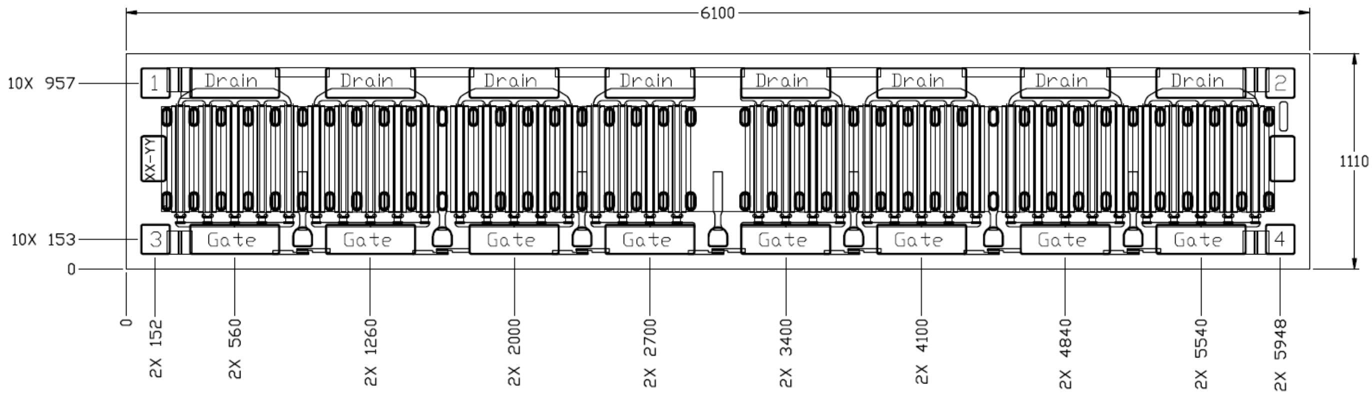
DIE Dimensions (units in microns)



Overall die size 6100 x 1110 (+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.
- 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.

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Typical Performance

Figure 1. – CGHV40320D Output Power, Gain and Efficiency vs. Input Power at Tcase = 25°C
V_{DD} = 50V, I_{DQ} = 500 mA, Frequency = 2.7 GHz

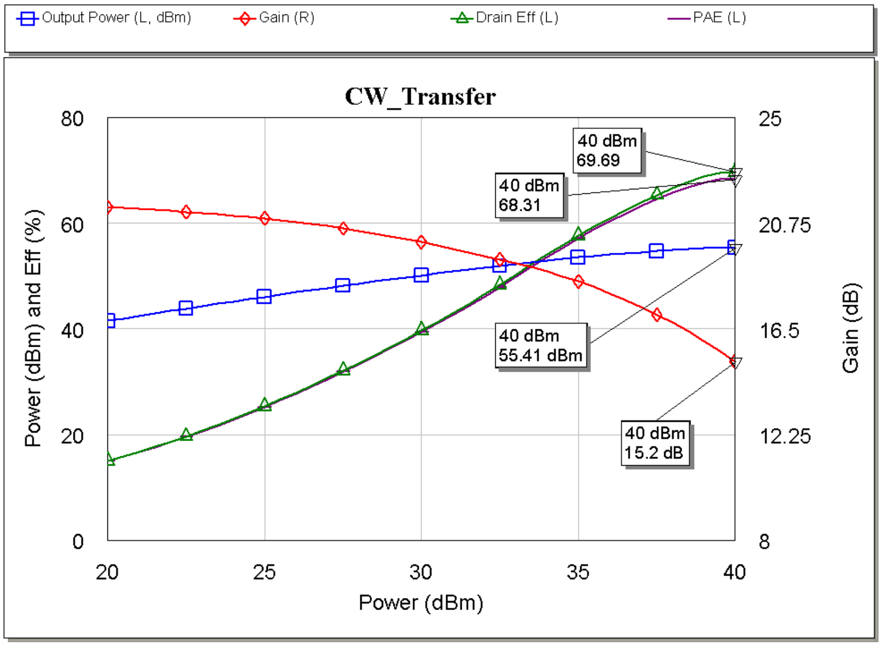
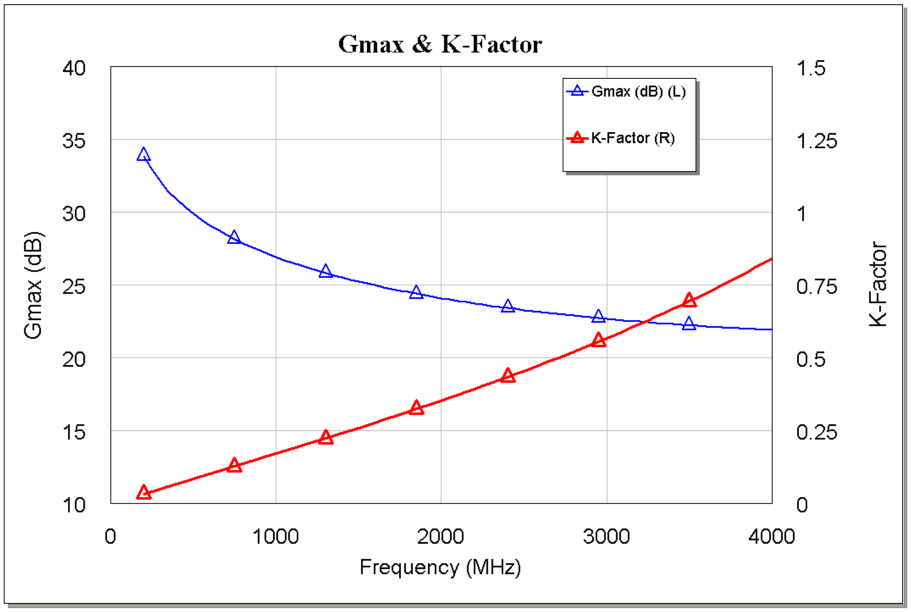


Figure 2. – CGHV40320D GMAX and K Factor vs. Frequency at Tcase = 25°C
V_{DD} = 50V, I_{DQ} = 500 mA



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Typical Die S-Parameters (Small Signal, V_{DS} = 50 V, I_{DQ} = 500 mA, magnitude / angle)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
0.5	0.964	-175.19	5.49	73.16	0.005	-15.49	0.719	-171.16
0.6	0.966	-175.83	4.48	69.32	0.005	-19.04	0.732	-170.45
0.7	0.967	-176.28	3.75	65.72	0.005	-22.35	0.746	-169.86
0.8	0.969	-176.62	3.20	62.34	0.005	-25.45	0.761	-169.41
0.9	0.970	-176.88	2.77	59.16	0.005	-28.35	0.776	-169.08
1	0.972	-177.10	2.42	56.17	0.005	-31.06	0.790	-168.88
1.1	0.973	-177.28	2.14	53.35	0.005	-33.59	0.804	-168.78
1.2	0.974	-177.44	1.90	50.70	0.004	-35.96	0.817	-168.76
1.3	0.976	-177.59	1.70	48.21	0.004	-38.16	0.829	-168.81
1.4	0.977	-177.71	1.53	45.87	0.004	-40.22	0.841	-168.91
1.5	0.978	-177.83	1.38	43.66	0.004	-42.13	0.852	-169.06
1.6	0.979	-177.95	1.25	41.59	0.004	-43.91	0.862	-169.24
1.7	0.980	-178.05	1.14	39.65	0.004	-45.56	0.871	-169.44
1.8	0.981	-178.15	1.04	37.81	0.004	-47.11	0.879	-169.66
1.9	0.982	-178.24	0.96	36.08	0.003	-48.54	0.887	-169.89
2	0.983	-178.33	0.88	34.45	0.003	-49.88	0.895	-170.12
2.1	0.984	-178.42	0.81	32.90	0.003	-51.12	0.901	-170.36
2.2	0.985	-178.50	0.75	31.44	0.003	-52.28	0.907	-170.61
2.3	0.985	-178.58	0.70	30.06	0.003	-53.36	0.913	-170.85
2.4	0.986	-178.65	0.65	28.75	0.003	-54.37	0.918	-171.08
2.5	0.987	-178.73	0.61	27.50	0.003	-55.30	0.923	-171.32
2.6	0.987	-178.80	0.57	26.32	0.003	-56.17	0.927	-171.55
2.7	0.988	-178.86	0.53	25.19	0.003	-56.99	0.931	-171.77
2.8	0.988	-178.93	0.50	24.11	0.002	-57.74	0.935	-171.99
2.9	0.989	-178.99	0.47	23.08	0.002	-58.45	0.938	-172.20
3	0.989	-179.05	0.44	22.10	0.002	-59.10	0.942	-172.41
3.2	0.990	-179.17	0.39	20.26	0.002	-60.28	0.947	-172.80
3.4	0.990	-179.28	0.35	18.56	0.002	-61.29	0.952	-173.17
3.6	0.991	-179.39	0.32	16.99	0.002	-62.15	0.957	-173.52
3.8	0.991	-179.49	0.29	15.54	0.002	-62.87	0.960	-173.84
4	0.992	-179.58	0.26	14.18	0.002	-63.47	0.964	-174.15
4.2	0.992	-179.68	0.24	12.90	0.002	-63.94	0.967	-174.43
4.4	0.992	-179.76	0.22	11.71	0.001	-64.30	0.969	-174.70
4.6	0.993	-179.85	0.20	10.58	0.001	-64.55	0.971	-174.96
4.8	0.993	-179.93	0.19	9.51	0.001	-64.68	0.973	-175.20
5	0.993	179.99	0.17	8.50	0.001	-64.70	0.975	-175.42
5.2	0.993	179.92	0.16	7.54	0.001	-64.59	0.977	-175.64
5.4	0.993	179.84	0.15	6.62	0.001	-64.35	0.978	-175.84
5.6	0.994	179.77	0.14	5.75	0.001	-63.96	0.980	-176.03
5.8	0.994	179.70	0.13	4.91	0.001	-63.41	0.981	-176.22
6	0.994	179.63	0.12	4.10	0.001	-62.68	0.982	-176.39

To download the s-parameters in s2p format, go to the CGHV40320D Product Page and click the documentation tab.

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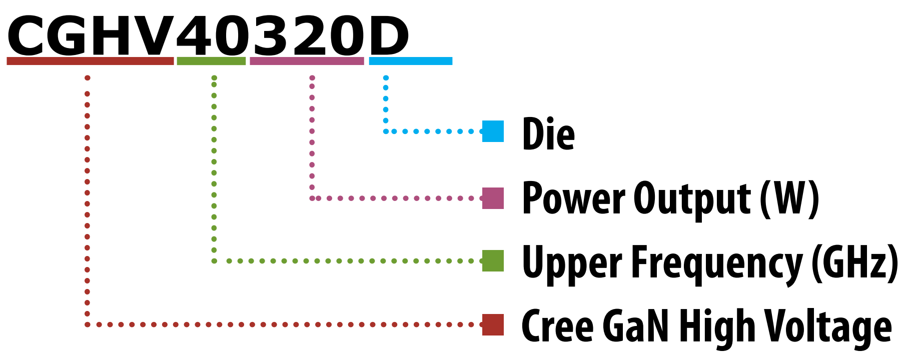
Part Number System



Parameter	Value	Units
Upper Frequency[1]	4.0	GHz
Power Output	320	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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