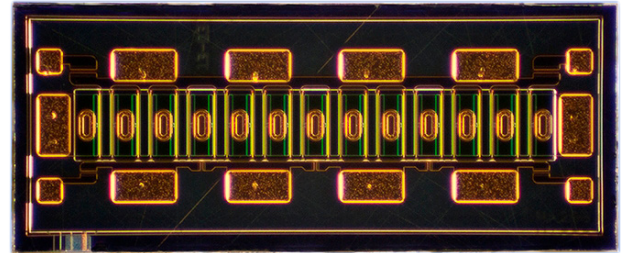


CGHV1J025D

25 W, 18.0 GHz, GaN HEMT Die

Description

Cree's CGHV1J025D is a high voltage gallium nitride (GaN) High Electron Mobility Transistor (HEMT) on a silicon carbide substrate, using a 0.25 μm gate length fabrication process. This GaN-on-SiC product offers superior high frequency, high efficiency features. It is ideal for a variety of applications operating from 10 MHz to 18 GHz at 40 V with a high breakdown voltage.



PN: CGHV1J025D

Features

- 17 dB Typ. Small Signal Gain at 10 GHz
- 60% Typ. PAE at 10 GHz
- 25 W Typical P_{SAT}
- 40 V Operation
- Up to 18 GHz Operation

Applications

- Satellite Communications
- PTP Communications Links
- Marine Radar
- Pleasure Craft Radar
- Port Vessel Traffic Services
- Broadband Amplifiers
- High Efficiency Amplifiers



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

Absolute Maximum Ratings (not simultaneous)

Parameter	Symbol	Rating	Units	Conditions
Drain-Source Voltage	V_{DSS}	120	V_{DC}	25 °C
Gate-to-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 Forward Gate Current	I_{GMAX}	4.8	mA	25 °C
Maximum Drain Current ¹	I_{DMAX}	2.0	A	25 °C
Thermal Resistance, Junction to Case (packaged) ²	$R_{\theta JC}$	5.83	°C/W	85 °C
Thermal Resistance, Junction to Case (die only) ²	$R_{\theta JC}$	3.91	°C/W	85 °C
Mounting Temperature	T_s	320	°C	30 seconds

Note¹ Current limit for long term, reliable operation.

Note² Eutectic die attach using 0.5 mil thick 80/20 AuSn mounted to a 40 mil thick CMC carrier.

Bottom of the CMC carrier fixed at 85°C at 19.2 W dissipated power.

Electrical Characteristics (Frequency = 10 GHz unless otherwise stated; $T_c = 25^\circ\text{C}$)

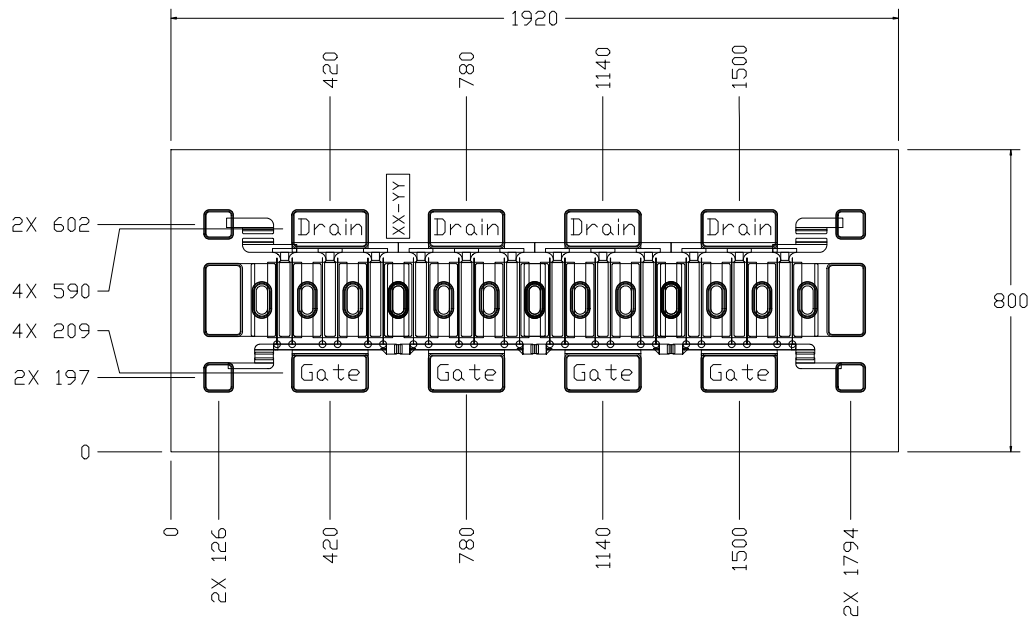
Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
DC Characteristics						
Gate Threshold Voltage	$V_{(GS)TH}$	-3.8	-3.0	-2.3	V	$V_{DS} = 10\text{ V}$, $I_D = 4.8\text{ mA}$
Gate Quiescent Voltage	$V_{(GS)Q}$	–	-2.7	–	VDC	$V_{DD} = 40\text{ V}$, $I_{DQ} = 240\text{ mA}$
Saturated Drain Current ¹	I_{SAT}	3.8	4.3	–	A	$V_{DS} = 6.0\text{ V}$, $V_{GS} = 2.0\text{ V}$
Drain-Source Breakdown Voltage	V_{BD}	100	–	–	V	$V_{DS} = -8\text{ V}$, $I_D = 4.8\text{ mA}$
On Resistance	R_{ON}	–	0.6	–	Ω	$V_{DS} = 0.1\text{ V}$, $V_{GS} = 0\text{ V}$
Gate Forward Voltage	V_{G-ON}	–	1.85	–	V	$I_{GS} = 4.8\text{ mA}$
RF Characteristics						
Small Signal Gain	G_{SS}	–	17	–	dB	$V_{DD} = 40\text{ V}$, $I_{DQ} = 240\text{ mA}$
Saturated Power Output ¹	P_{SAT}	–	25	–	W	$V_{DD} = 40\text{ V}$, $I_{DQ} = 240\text{ mA}$
Drain Efficiency ²	η	–	60	–	%	$V_{DD} = 40\text{ V}$, $I_{DQ} = 240\text{ mA}$
Intermodulation Distortion	IM3	–	-30	–	dBc	$V_{DD} = 40\text{ V}$, $I_{DQ} = 240\text{ mA}$, $P_{OUT} = 25\text{ W PEP}$
Output Mismatch Stress	VSWR	–	–	10 : 1	Ψ	No damage at all phase angles, $V_{DD} = 40\text{ V}$, $I_{DQ} = 240\text{ mA}$, $P_{OUT} = 25\text{ W CW}$
Dynamic Characteristics						
Input Capacitance	C_{GS}	–	5.1	–	pF	$V_{DS} = 28\text{ V}$, $V_{GS} = -8\text{ V}$, $f = 1\text{ MHz}$
Output Capacitance	C_{DS}	–	1.2	–	pF	$V_{DS} = 28\text{ V}$, $V_{GS} = -8\text{ V}$, $f = 1\text{ MHz}$
Feedback Capacitance	C_{GD}	–	0.16	–	pF	$V_{DS} = 28\text{ V}$, $V_{GS} = -8\text{ V}$, $f = 1\text{ MHz}$

Notes:

¹ Scaled from PCM unit cell

² P_{SAT} is defined as $I_G = 0.48\text{ mA}$

³ Drain Efficiency = P_{OUT} / P_{DC}

DIE Dimensions (units in microns)

Overall die size 800 x 1920 (+0/- 50) microns, die thickness 100 (+/- 10) microns.
All Gate and Drain pads must be wire bonded for electrical connection.

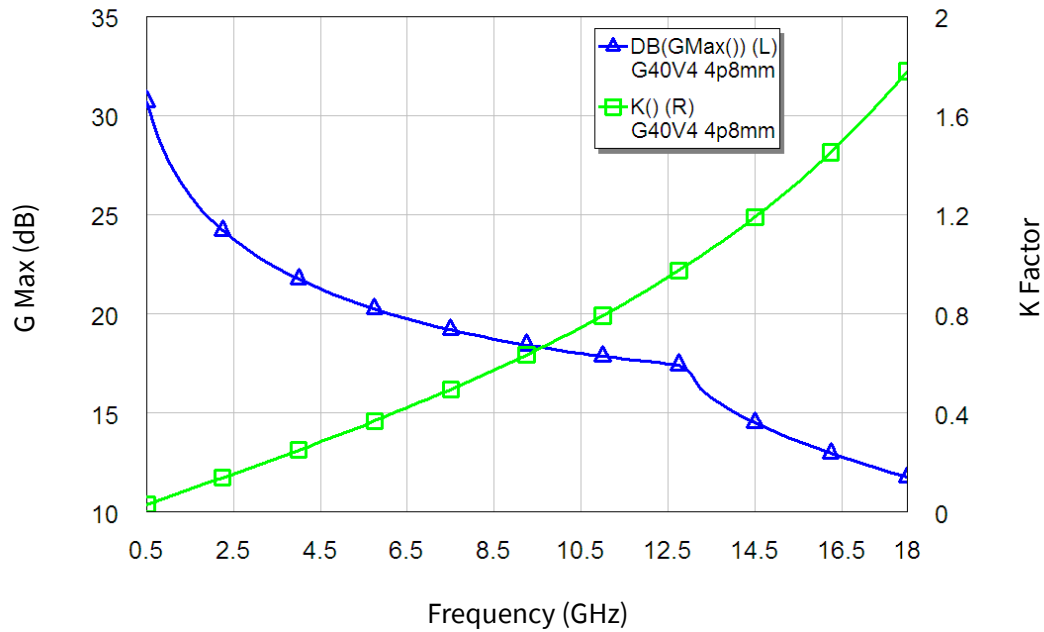
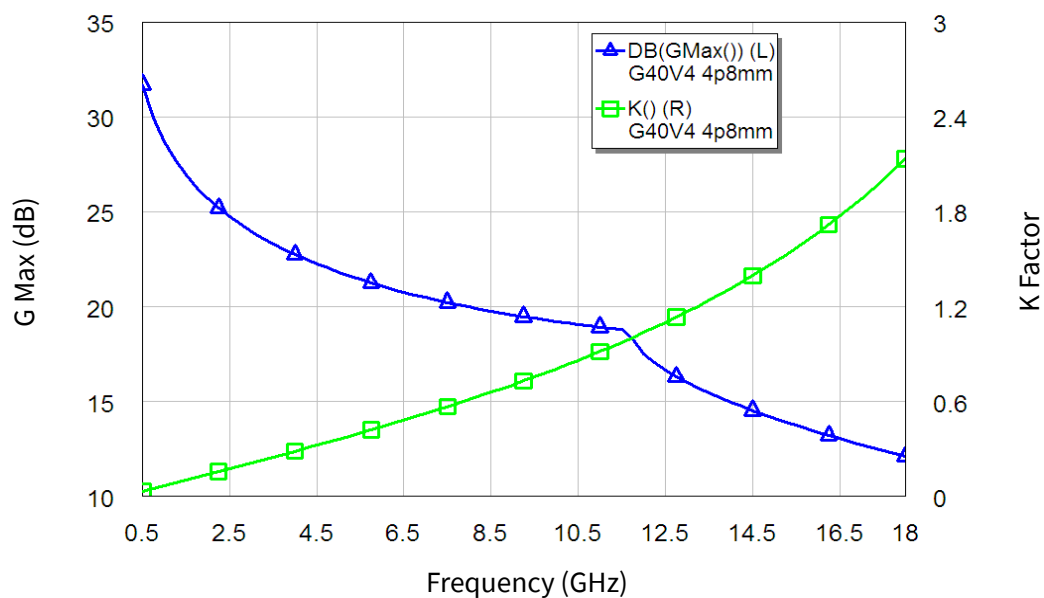
Pad	Size (microns)
Drain	200 x 100
Gate	200 x 100
Interconnect	80 x 80

Assembly Notes:

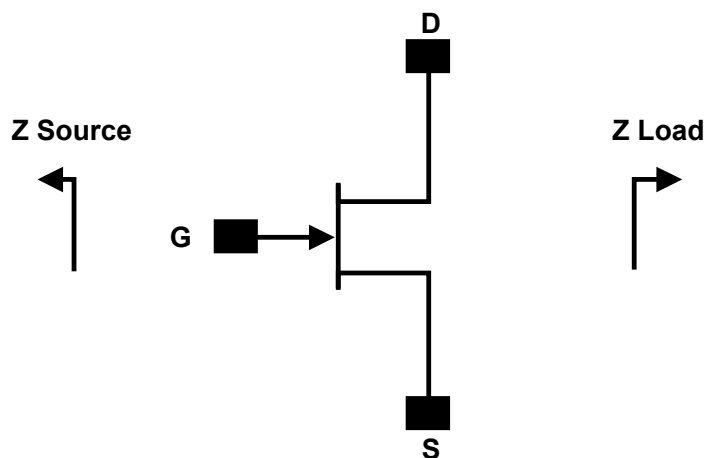
- Recommended solder is AuSn (80/20) solder. Refer to Cree's website for the Eutectic Die Bond Procedure application note at http://www.cree.com/products/wireless_documents.asp
- Vacuum collet is the preferred method of pick-up
- The backside of the die is the Source (ground) contact
- Die back side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

Gmax and K Factor**Figure 1. CGHV1J025D - Stability with Gmax and K Factor** $V_{DD} = 40\text{ V}, I_{DS} = 120\text{ mA}$ **Figure 2. CGHV1J025D - Stability with Gmax and K Factor** $V_{DD} = 40\text{ V}, I_{DS} = 240\text{ mA}$ 

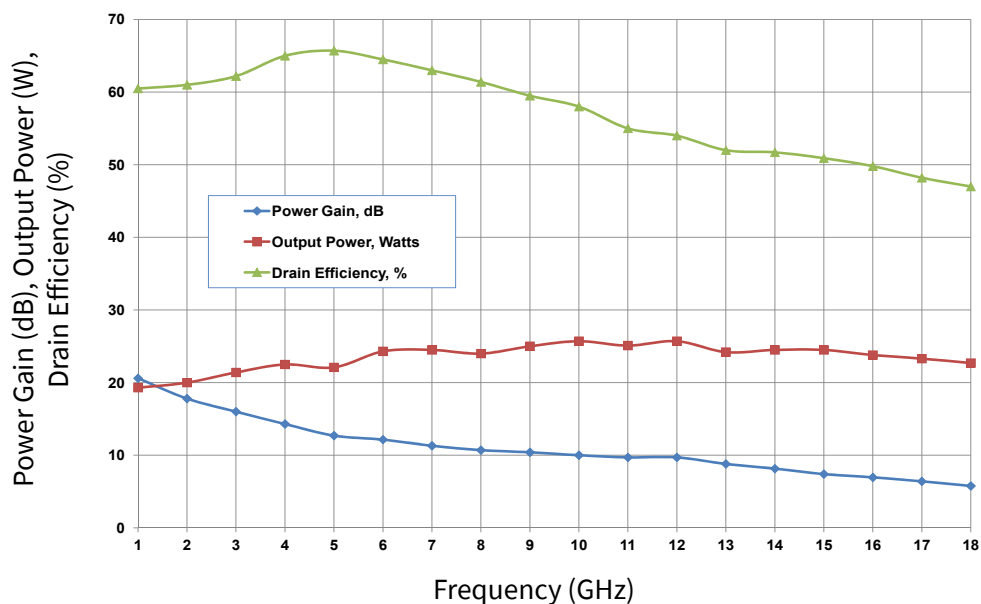
Source and Load Impedances



Frequency	Z Source	Z Load
1.0	$8.1 + j10.8$	$31.4 + j24.75$
2.0	$3.9 + j5.43$	$17.6 + j23.4$
3.0	$2.35 + j3.48$	$9.57 + j19.67$
4.0	$1.81 + j2.49$	$6.52 + j16.94$
5.0	$1.47 + j1.67$	$4.22 + j14.57$
6.0	$1.36 + j1.365$	$3.73 + j12.4$
7.0	$1.377 + j0.97$	$3.06 + j10.82$
8.0	$1.32 + j0.6$	$2.47 + j9.6$
9.0	$1.16 + j0.32$	$2.22 + j8.53$
10.0	$0.957 + j0.07$	$2.1 + j7.67$
11.0	$1 + j0.01$	$1.94 + j6.96$
12.0	$0.548 + j0.01$	$1.87 + j6.186$
13.0	$76 + j0$	$1.6 + j5.63$
14.0	$0.69 - j0.34$	$1.4 + j5.1$
15.0	$0.437 - j0.78$	$1.22 + j4.68$
16.0	$0.44 - j0.99$	$1.07 + j4.25$
17.0	$0.416 - j1.23$	$0.97 + j3.81$
18.0	$0.45 - j1.434$	$0.87 + j3.47$

Note: $V_{DD} = 40\text{ V}$, $I_{DQ} = 178\text{ mA}$

Figure 3. CGHV1J025D - Power Gain, Output Power and Drain Efficiency using Source and Load Pull Impedances (Series gate stability resistor values chosen to make $K > 1$)





Typical S-Parameters for CGHV1J025D
(Small Signal, $V_{DS} = 40$ V, $I_{DQ} = 120$ mA, angle in degrees)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.928	-124.66	23.24	109.88	0.020	20.43	0.360	-95.71
1.00 GHz	0.918	-150.14	12.40	91.05	0.021	2.17	0.361	-115.87
1.50 GHz	0.919	-159.38	8.19	80.38	0.021	-7.95	0.408	-122.40
2.00 GHz	0.922	-164.05	5.98	72.24	0.020	-15.53	0.466	-126.33
2.50 GHz	0.927	-166.89	4.61	65.39	0.020	-21.82	0.524	-129.70
3.00 GHz	0.932	-168.83	3.68	59.40	0.019	-27.25	0.579	-132.87
3.50 GHz	0.937	-170.28	3.01	54.08	0.018	-32.00	0.628	-135.88
4.00 GHz	0.942	-171.43	2.51	49.32	0.017	-36.21	0.671	-138.72
4.50 GHz	0.946	-172.38	2.12	45.03	0.016	-39.94	0.708	-141.37
5.00 GHz	0.950	-173.20	1.82	41.14	0.015	-43.26	0.741	-143.82
5.50 GHz	0.954	-173.92	1.57	37.61	0.014	-46.22	0.769	-146.08
6.00 GHz	0.957	-174.57	1.37	34.39	0.013	-48.87	0.793	-148.15
6.50 GHz	0.960	-175.16	1.20	31.45	0.013	-51.25	0.814	-150.06
7.00 GHz	0.962	-175.70	1.07	28.73	0.012	-53.39	0.832	-151.80
7.50 GHz	0.965	-176.19	0.95	26.23	0.011	-55.32	0.847	-153.41
8.00 GHz	0.966	-176.66	0.85	23.91	0.011	-57.07	0.861	-154.89
8.50 GHz	0.968	-177.10	0.77	21.74	0.010	-58.65	0.873	-156.25
9.00 GHz	0.970	-177.51	0.70	19.72	0.010	-60.09	0.883	-157.51
9.50 GHz	0.971	-177.90	0.63	17.83	0.009	-61.40	0.892	-158.68
10.00 GHz	0.972	-178.27	0.58	16.04	0.009	-62.59	0.900	-159.77
10.50 GHz	0.973	-178.63	0.53	14.36	0.008	-63.68	0.907	-160.78
11.00 GHz	0.974	-178.97	0.49	12.76	0.008	-64.67	0.914	-161.72
11.50 GHz	0.975	-179.30	0.45	11.25	0.008	-65.58	0.919	-162.61
12.00 GHz	0.976	-179.61	0.42	9.80	0.007	-66.42	0.924	-163.44
12.50 GHz	0.976	-179.92	0.39	8.42	0.007	-67.18	0.929	-164.22
13.00 GHz	0.977	-179.78	0.36	7.10	0.007	-67.87	0.933	-164.96
13.50 GHz	0.977	-179.49	0.34	5.83	0.006	-68.51	0.937	-165.65
14.00 GHz	0.978	-179.21	0.32	4.61	0.006	-69.08	0.940	-166.31
14.50 GHz	0.978	-178.93	0.30	3.44	0.006	-69.60	0.943	-166.94
15.00 GHz	0.979	-178.66	0.28	2.30	0.006	-70.07	0.946	-167.53
15.25 GHz	0.979	-178.53	0.27	1.75	0.005	-70.29	0.947	-167.82
15.50 GHz	0.979	-178.40	0.26	1.20	0.005	-70.49	0.948	-168.10
15.75 GHz	0.979	-178.26	0.26	0.67	0.005	-70.68	0.949	-168.37
16.00 GHz	0.979	-178.13	0.25	0.14	0.005	-70.86	0.951	-168.64
16.25 GHz	0.979	-178.00	0.24	-0.38	0.005	-71.03	0.952	-168.90
16.50 GHz	0.980	-177.88	0.24	-0.89	0.005	-71.19	0.953	-169.16
16.75 GHz	0.980	-177.75	0.23	-1.40	0.005	-71.33	0.954	-169.41
17.00 GHz	0.980	-177.62	0.22	-1.89	0.005	-71.46	0.955	-169.65
17.25 GHz	0.980	-177.50	0.22	-2.39	0.004	-71.58	0.955	-169.89
17.50 GHz	0.980	-177.37	0.21	-2.87	0.004	-71.69	0.956	-170.13
17.75 GHz	0.980	-177.25	0.21	-3.35	0.004	-71.78	0.957	-170.36
18.00 GHz	0.980	-177.13	0.20	-3.82	0.004	-71.87	0.958	-170.58

To download the s-parameters in s2p format, go to the [CGHV1J025D Product Page](#) and click on the documentation tab.



Typical S-Parameters for CGHV1J025D
(Small Signal, $V_{DS} = 40$ V, $I_{DQ} = 240$ mA, angle in degrees)

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.936	-131.40	24.37	107.30	0.017	17.88	0.330	-112.72
1.00 GHz	0.928	-154.25	12.80	90.22	0.017	1.38	0.350	-128.83
1.50 GHz	0.929	-162.37	8.46	80.49	0.017	-7.76	0.396	-132.36
2.00 GHz	0.932	-166.47	6.19	72.98	0.017	-14.68	0.450	-134.10
2.50 GHz	0.935	-168.95	4.80	66.58	0.016	-20.49	0.504	-135.82
3.00 GHz	0.939	-170.65	3.85	60.92	0.015	-25.56	0.556	-137.73
3.50 GHz	0.943	-171.91	3.17	55.83	0.015	-30.06	0.603	-139.77
4.00 GHz	0.947	-172.91	2.65	51.23	0.014	-34.07	0.646	-141.86
4.50 GHz	0.950	-173.73	2.25	47.04	0.013	-37.67	0.684	-143.92
5.00 GHz	0.954	-174.45	1.93	43.22	0.013	-40.89	0.717	-145.91
5.50 GHz	0.957	-175.07	1.68	39.72	0.012	-43.79	0.746	-147.80
6.00 GHz	0.959	-175.64	1.47	36.51	0.011	-46.40	0.771	-149.58
6.50 GHz	0.962	-176.15	1.30	33.55	0.011	-48.75	0.793	-151.25
7.00 GHz	0.964	-176.63	1.15	30.82	0.010	-50.87	0.812	-152.81
7.50 GHz	0.966	-177.07	1.03	28.29	0.010	-52.79	0.829	-154.26
8.00 GHz	0.968	-177.48	0.92	25.93	0.009	-54.53	0.844	-155.62
8.50 GHz	0.969	-177.87	0.83	23.73	0.009	-56.11	0.857	-156.88
9.00 GHz	0.970	-178.25	0.76	21.67	0.008	-57.54	0.868	-158.05
9.50 GHz	0.972	-178.60	0.69	19.74	0.008	-58.84	0.878	-159.15
10.00 GHz	0.973	-178.94	0.63	17.91	0.008	-60.02	0.887	-160.17
10.50 GHz	0.974	-179.27	0.58	16.19	0.007	-61.10	0.895	-161.13
11.00 GHz	0.975	-179.58	0.54	14.55	0.007	-62.07	0.902	-162.04
11.50 GHz	0.975	-179.88	0.49	13.00	0.007	-62.96	0.909	-162.88
12.00 GHz	0.976	-179.82	0.46	11.52	0.006	-63.76	0.914	-163.68
12.50 GHz	0.977	-179.54	0.43	10.10	0.006	-64.49	0.919	-164.43
13.00 GHz	0.977	-179.26	0.40	8.74	0.006	-65.14	0.924	-165.15
13.50 GHz	0.978	-178.99	0.37	7.44	0.005	-65.72	0.928	-165.82
14.00 GHz	0.978	-178.72	0.35	6.19	0.005	-66.24	0.932	-166.46
14.50 GHz	0.978	-178.46	0.33	4.98	0.005	-66.70	0.936	-167.07
15.00 GHz	0.979	-178.20	0.31	3.82	0.005	-67.09	0.939	-167.65
15.25 GHz	0.979	-178.08	0.30	3.25	0.005	-67.26	0.940	-167.93
15.50 GHz	0.979	-177.95	0.29	2.69	0.004	-67.42	0.942	-168.21
15.75 GHz	0.979	-177.82	0.28	2.15	0.004	-67.57	0.943	-168.47
16.00 GHz	0.979	-177.70	0.28	1.60	0.004	-67.69	0.944	-168.74
16.25 GHz	0.980	-177.58	0.27	1.07	0.004	-67.81	0.945	-168.99
16.50 GHz	0.980	-177.45	0.26	0.55	0.004	-67.90	0.947	-169.24
16.75 GHz	0.980	-177.33	0.25	0.03	0.004	-67.99	0.948	-169.49
17.00 GHz	0.980	-177.21	0.25	-0.48	0.004	-68.05	0.949	-169.73
17.25 GHz	0.980	-177.09	0.24	-0.98	0.004	-68.10	0.950	-169.97
17.50 GHz	0.980	-176.97	0.23	-1.48	0.004	-68.14	0.951	-170.20
17.75 GHz	0.980	-176.85	0.23	-1.97	0.004	-68.15	0.952	-170.43
18.00 GHz	0.980	-176.73	0.22	-2.45	0.003	-68.15	0.953	-170.65

To download the s-parameters in s2p format, go to the [CGHV1J025D Product Page](#) and click on the documentation tab.

Part Number System

CGHV1J025D

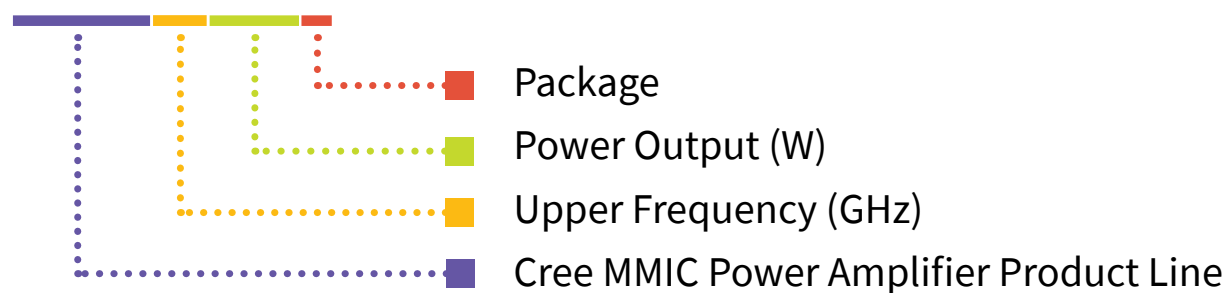


Table 1.

Parameter	Value	Units
Lower Frequency	DC	GHz
Upper Frequency ¹	18.0	GHz
Power Output	25	W
Package	Bare Die	-

Note¹: 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

**Electrostatic Discharge (ESD) Classifications**

Parameter	Symbol	Class	Test Methodology
Human Body Model	HBM	1A (> 250 V)	JEDEC JESD22 A114-D
Charge Device Model	CDM	II (200 < 500 V)	JEDEC JESD22 C101-C

Product Ordering Information

Order Number	Description	Unit of Measure
CGHV1J025D	GaN HEMT Bare Die	Each

For more information, please contact:

4600 Silicon Drive
Durham, North Carolina, USA 27703
www.wolfspeed.com/RF

Sales Contact
RFSales@cree.com

Notes

Disclaimer

Specifications are subject to change without notice. “Typical” parameters are the average values expected by Cree in large quantities and are provided for information purposes only. Cree products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death. No responsibility is assumed by Cree for any infringement of patents or other rights of third parties which may result from use of the information contained herein. No license is granted by implication or otherwise under any patent or patent rights of Cree.