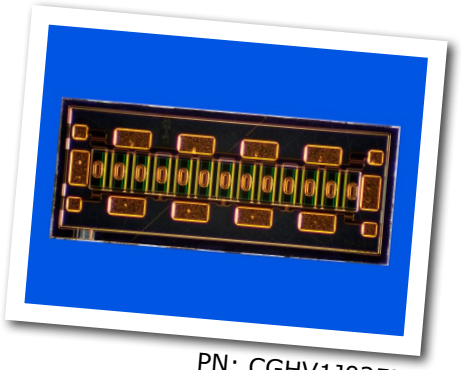
# CGHV1J025D

## 25 W, 18.0 GHz, GaN HEMT Die

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.



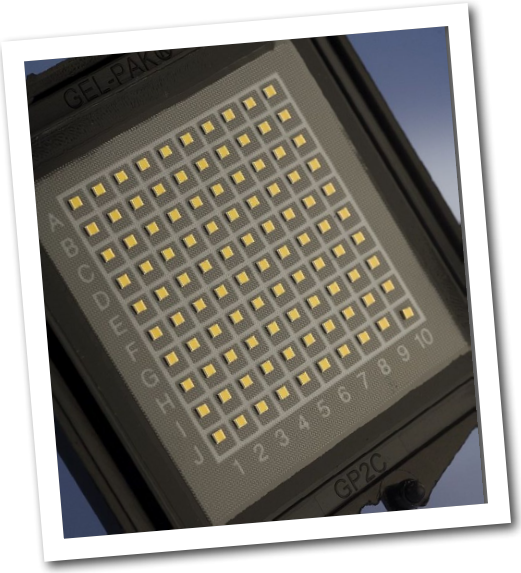
PN: CGHV1J025D

### FEATURES

- 17 dB Typ. Small Signal Gain at 10 GHz
- 60% Typ. PAE at 10 GHz
- 25 W Typical Psat
- 40 V Operation
- Up to 18GHz 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 or on tape.
- Non-adhesive tacky membrane immobilizes die during shipment.

**Large Signal Models Available for SiC & GaN**

## Absolute Maximum Ratings (not simultaneous)

| Parameter | Symbol | Rating | Units | Conditions |
|---|---|---|---|---|
| Drain-source Voltage | $V_{DSS}$ | 100 | $V_{DC}$ | 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 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 |

Note[1] Current limit for long term reliable operation.
Note[2] 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 and is at 19.2 W dissipated power.

## Electrical Characteristics (Frequency = 10 GHz unless otherwise stated; $T_C$ = 25˚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 V, $I_D$ = 4.8 mA |
| Gate Quiescent Voltage | $V_{(GS)Q}$ | – | -2.7 | – | VDC | $V_{DD}$ = 40 V, $I_{DQ}$ = 240 mA |
| Saturated Drain Current[1] | $I_{SAT}$ | 3.8 | 4.3 | – | A | $V_{DS}$ = 6.0 V, $V_{GS}$ = 2.0 V |
| Drain-Source Breakdown Voltage | $V_{BD}$ | 100 | – | – | V | $V_{GS}$ = -8 V, $I_D$ = 4.8 mA |
| On Resistance | $R_{ON}$ | – | 0.6 | – | Ω | $V_{DS}$ = 0.1 V, $V_{GS}$ = 0 V |
| Gate Forward Voltage | $V_{G-ON}$ | – | 1.85 | – | V | $I_{GS}$ = 4.8 mA |
| **RF Characteristics** | | | | | | |
| Small Signal Gain | $G_{SS}$ | – | 17 | – | dB | $V_{DD}$ = 40 V, $I_{DQ}$ = 240 mA |
| Saturated Power Output[1] | $P_{SAT}$ | – | 25 | – | W | $V_{DD}$ = 40 V, $I_{DQ}$ = 240 mA |
| Drain Efficiency[2] | η | – | 60 | – | % | $V_{DD}$ = 40 V, $I_{DQ}$ = 240 mA |
| Intermodulation Distortion | IM3 | – | -30 | – | dBc | $V_{DD}$ = 40 V, $I_{DQ}$ = 240 mA, $P_{OUT}$ = 25 W PEP |
| Output Mismatch Stress | VSWR | – | – | 10 : 1 | Ψ | No damage at all phase angles, $V_{DD}$ = 40 V, $I_{DQ}$ = 240 mA, $P_{OUT}$ = 25 W CW |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | $C_{GS}$ | – | 5.1 | – | pF | $V_{DS}$ = 40 V, $V_{gs}$ = -8 V, f = 1 MHz |
| Output Capacitance | $C_{DS}$ | – | 1.2 | – | pF | $V_{DS}$ = 40 V, $V_{gs}$ = -8 V, f = 1 MHz |
| Feedback Capacitance | $C_{GD}$ | – | 0.16 | – | pF | $V_{DS}$ = 40 V, $V_{gs}$ = -8 V, f = 1 MHz |

Notes:
[1] Scaled from PCM unit cell.
[1] $P_{SAT}$ is defined as $I_G$ = 0.48 mA.
[2] Drain Efficiency = $P_{OUT}$ / $P_{DC}$



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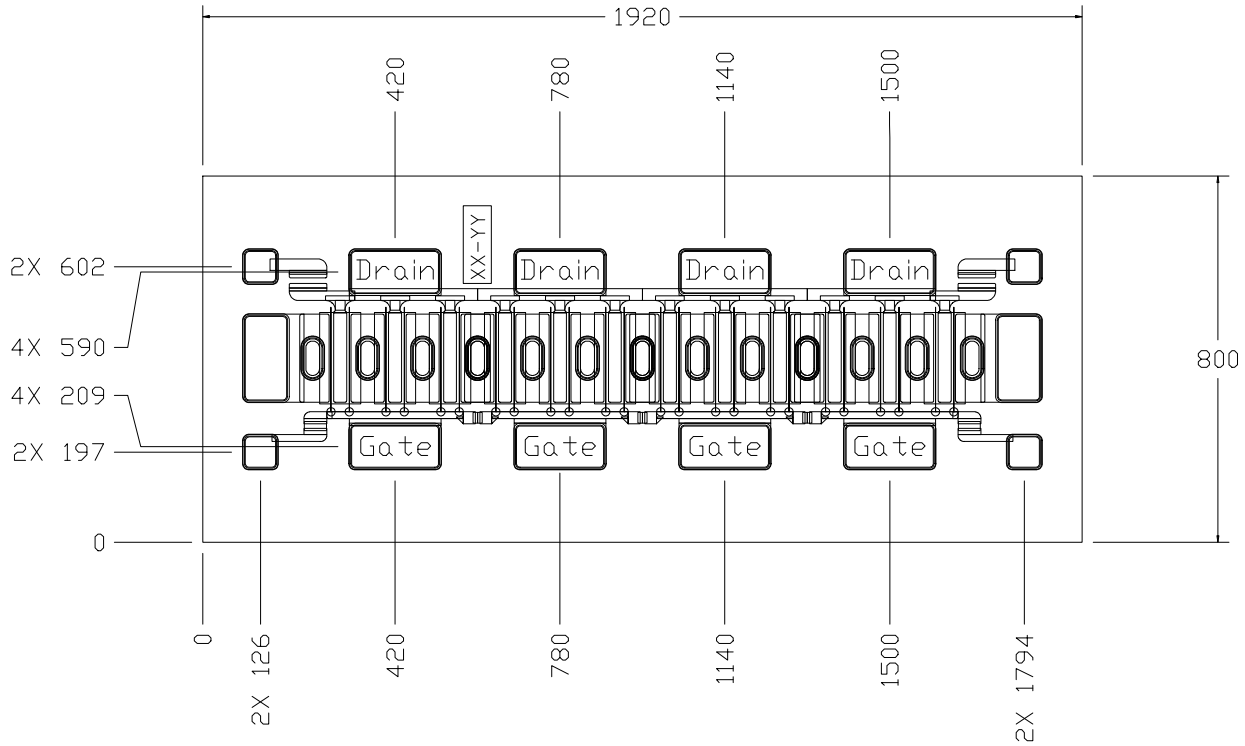
## Die Dimensions (units in microns)




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.



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## Gmax and K Factor

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

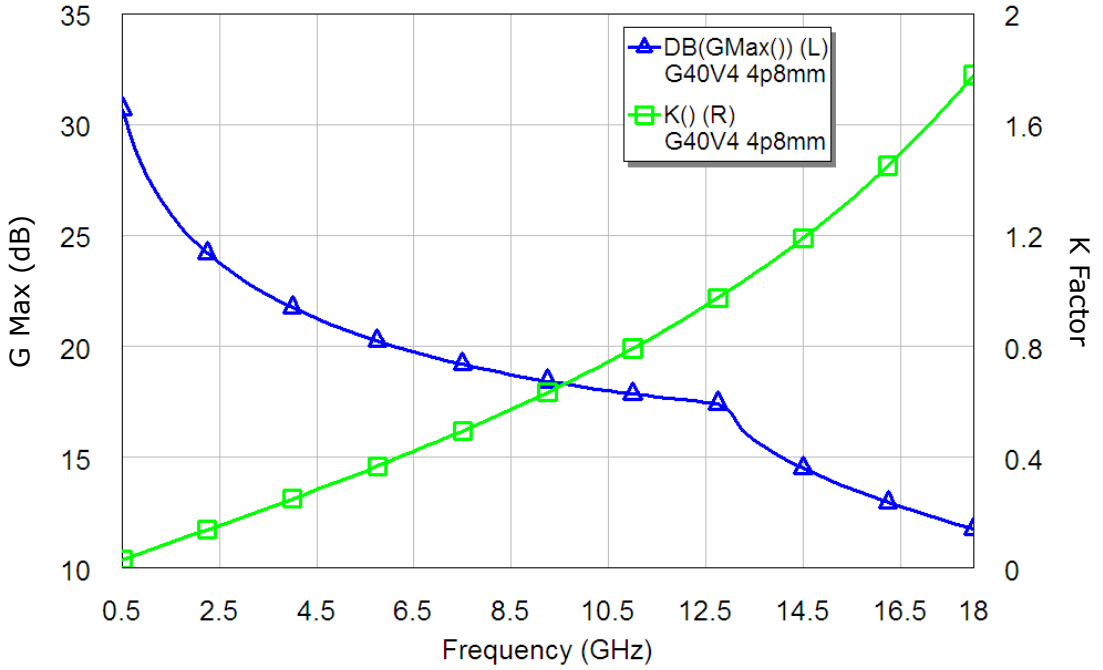
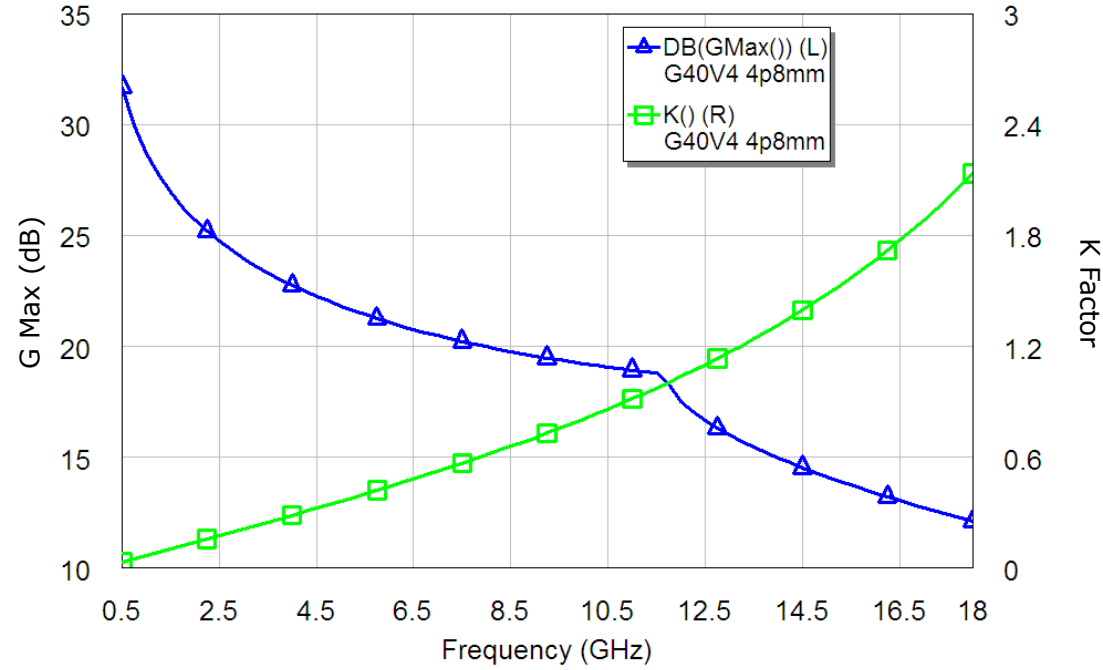



**Figure 2. CGHV1J025D - Stability with Gmax and K Factor**
**$V_{DD}$ = 40 V, $I_{DS}$ = 240 mA**



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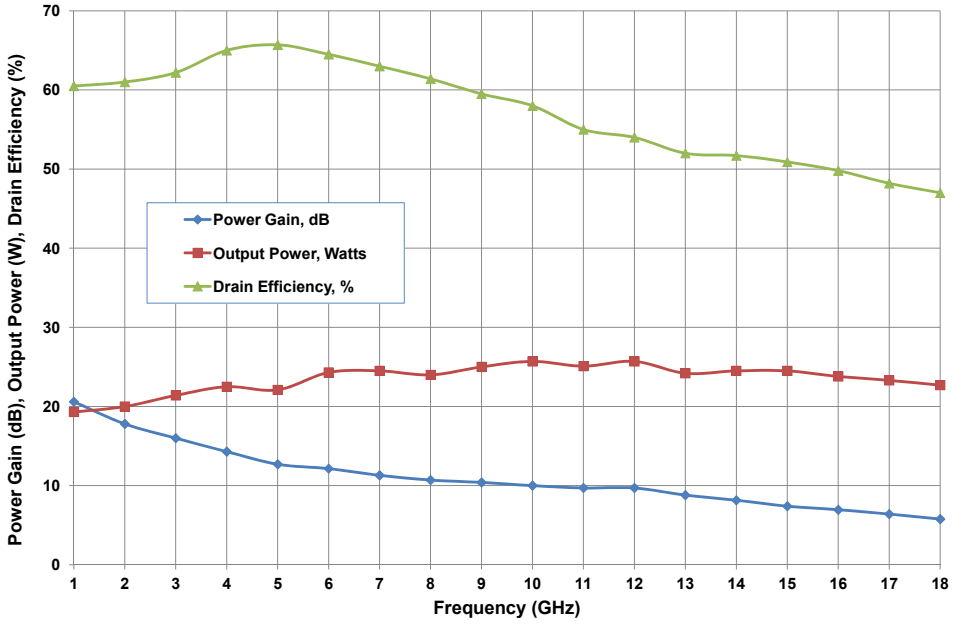
## Source and Load Impedances

| Frequency (GHz) | Source Impedance (ohms) | Load Impedance (ohms) | Series Gate Stability Resistor (ohms) |
|---|---|---|---|
| 1.0 | 8.1 + j10.8 | 31.4 + j24.75 | 7.00 |
| 2.0 | 3.9 + j5.43 | 17.6 + j23.4 | 3.30 |
| 3.0 | 2.35 + j3.48 | 9.57 + j19.67 | 2.05 |
| 4.0 | 1.81 + j2.49 | 6.52 + j16.94 | 1.40 |
| 5.0 | 1.47 + j1.67 | 4.22 + j14.57 | 0.95 |
| 6.0 | 1.36 + j1.365 | 3.73 + j12.4 | 0.70 |
| 7.0 | 1.377 + j0.97 | 3.06 + j10.82 | 0.525 |
| 8.0 | 1.32 + j0.6 | 2.47 + j9.6 | 0.425 |
| 9.0 | 1.16 + j0.32 | 2.22 + j8.53 | 0.275 |
| 10.0 | 0.957 + j0.07 | 2.1 + j7.67 | 0.175 |
| 11.0 | 1 + j0.01 | 1.94 + j6.96 | 0.10 |
| 12.0 | 0.548 + j0.01 | 1.87 + j6.186 | 0.025 |
| 13.0 | 76 +j0 | 1.6 + j5.63 | 0 |
| 14.0 | 0.69 – j0.34 | 1.4 + j5.1 | 0 |
| 15.0 | 0.437 – j0.78 | 1.22 + j4.68 | 0 |
| 16.0 | 0.44 – j0.99 | 1.07 + j4.25 | 0 |
| 17.0 | 0.416 – j1.23 | 0.97 + j3.81 | 0 |
| 18.0 | 0.45 – j1.434 | 0.87 + j3.47 | 0 |

**Table 1.**

**Note:** $V_{DD}$ = 40 V, $I_{DQ}$ = 178 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)**



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## 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 |

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## 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 |

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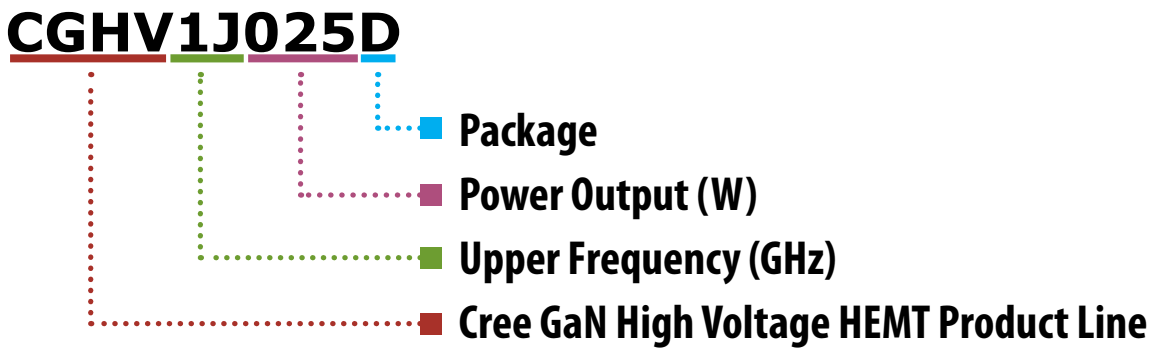
## Part Number System




| Parameter | Value | Units |
|---|---|---|
| Lower Frequency | DC | GHz |
| Upper Frequency[1] | 18.0 | GHz |
| Power Output | 25 | 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<br>2H = 27.0 GHz |

**Table 2.**



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Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
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- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
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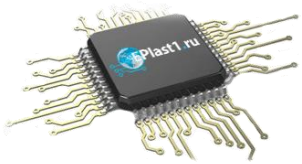
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.




**Как с нами связаться**

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