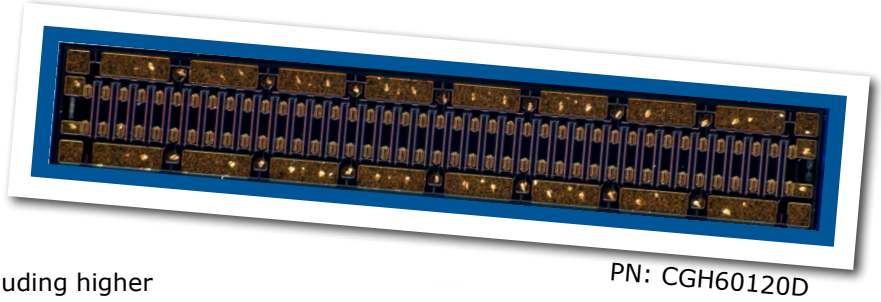
# CGH60120D

## 120 W, 6.0 GHz, GaN HEMT Die



PN: CGH60120D

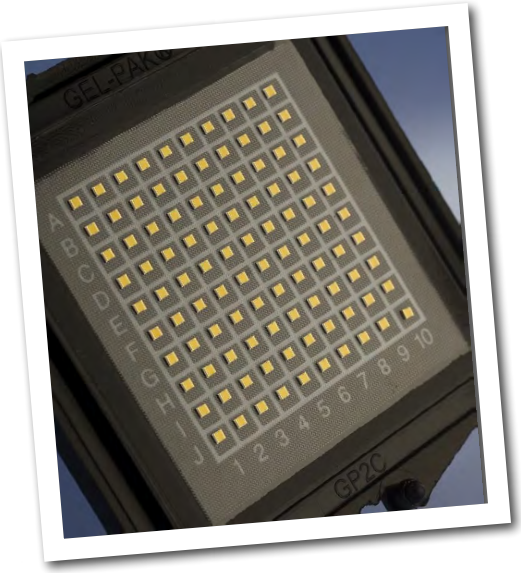
Cree's CGH60120D is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT). GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity, and higher thermal conductivity. GaN HEMTs offer greater power density and wider bandwidths compared to Si and GaAs transistors.

### FEATURES

- 13 dB Typical Small Signal Gain at 4 GHz
- 12 dB Typical Small Signal Gain at 6 GHz
- 120 W Typical $P_{SAT}$
- 28 V Operation
- High Breakdown Voltage
- High Temperature Operation
- Up to 6 GHz Operation
- High Efficiency

### APPLICATIONS

- 2-Way Private Radio
- Broadband Amplifiers
- Cellular Infrastructure
- Test Instrumentation
- Class A, AB, Linear amplifiers suitable for OFDM, W-CDMA, EDGE, CDMA waveforms




### Packaging Information

RoHS COMPLIANT

- Bare die are shipped in Gel-Pak® containers.
- Non-adhesive tacky membrane immobilizes die during shipment.

Large Signal Models Available for SiC & GaN

## Absolute Maximum Ratings (not simultaneous) at 25˚C

| Parameter | Symbol | Rating | Units | Conditions |
|---|---|---|---|---|
| Drain-source Voltage | $V_{DSS}$ | 84 | VDC | 25˚C |
| Gate-source Voltage | $V_{GS}$ | -10, +2 | VDC | 25˚C |
| Storage Temperature | $T_{STG}$ | -65, +150 | ˚C | |
| Operating Junction Temperature | $T_J$ | 225 | ˚C | |
| Maximum Forward Gate Current | $I_{GMAX}$ | 30 | mA | 25˚C |
| Maximum Drain Current[1] | $I_{DMAX}$ | 12 | A | 25˚C |
| Thermal Resistance, Junction to Case (packaged)[2] | $R_{\theta JC}$ | 1.5 | ˚C/W | |
| Thermal Resistance, Junction to Case (die only) | $R_{\theta JC}$ | 0.8 | ˚C/W | 85˚C |
| Mounting Temperature (30 seconds) | $T_S$ | 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 60 mil thick CuMoCu carrier.

## Electrical Characteristics (Frequency = 4 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, $I_D$ = 28.8 mA |
| Gate Quiescent Voltage | $V_{GS(Q)}$ | – | -2.7 | – | $V_{DC}$ | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA |
| Drain Current | $I_{DSS}$ | 23.2 | 28.0 | – | A | $V_{DS}$ = 6 V, $V_{GS}$ = 2.0 V |
| Drain-Source Breakdown Voltage | $V_{BD}$ | 120 | – | – | V | $V_{GS}$ = -8 V, $I_D$ = 28.8 mA |
| On Resistance | $R_{ON}$ | – | 0.1 | – | Ω | $V_{DS}$ = 0.1 V |
| Gate Forward Voltage | $V_{G-ON}$ | – | 1.9 | – | V | $I_{GS}$ = 28.8 mA |
| **RF Characteristics** | | | | | | |
| Small Signal Gain | $G_{SS}$ | – | 13 | – | dB | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA |
| Saturated Power Output[2] | $P_{SAT}$ | – | 120 | – | W | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA |
| Drain Efficiency[1] | η | – | 65 | – | % | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{SAT}$ = 120 W |
| Intermodulation Distortion | IM3 | – | -30 | – | dBc | $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{OUT}$ = 120 W PEP |
| Output Mismatch Stress | VSWR | – | – | 10 : 1 | Ψ | No damage at all phase angles, $V_{DD}$ = 28 V, $I_{DQ}$ = 800 mA, $P_{OUT}$ = 120 W CW |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | $C_{GS}$ | – | 34.0 | – | pF | $V_{DS}$ = 28 V, $V_{gs}$ = -8 V, f = 1 MHz |
| Output Capacitance | $C_{DS}$ | – | 7.7 | – | pF | $V_{DS}$ = 28 V, $V_{gs}$ = -8 V, f = 1 MHz |
| Feedback Capacitance | $C_{GD}$ | – | 1.5 | – | pF | $V_{DS}$ = 28 V, $V_{gs}$ = -8 V, f = 1 MHz |

Notes:

[1] Drain Efficiency = $P_{OUT}$ / $P_{DC}$

[2] $P_{SAT}$ is defined as $I_G$ = 3.0 mA.

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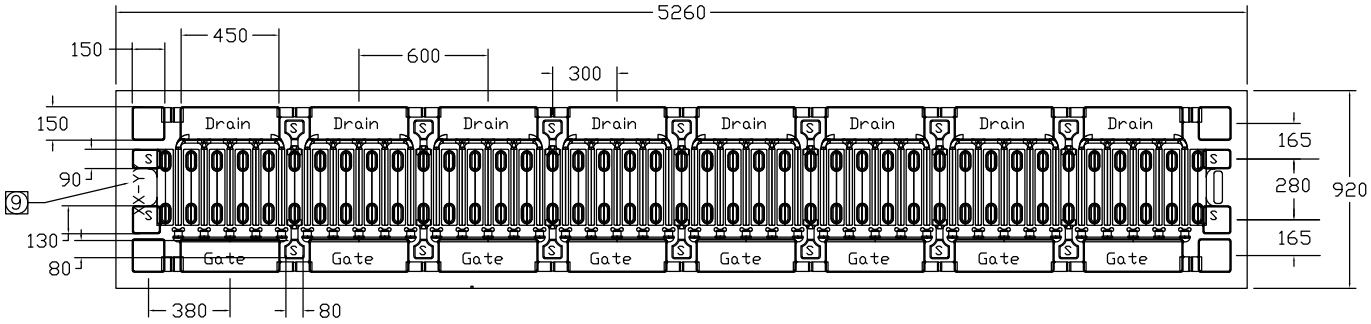
## DIE Dimensions (units in microns)




Overall die size 5260 x 920 (+0/-50) microns, die thickness 100 (+/- 10) 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, see arrow 9 in the drawing above.

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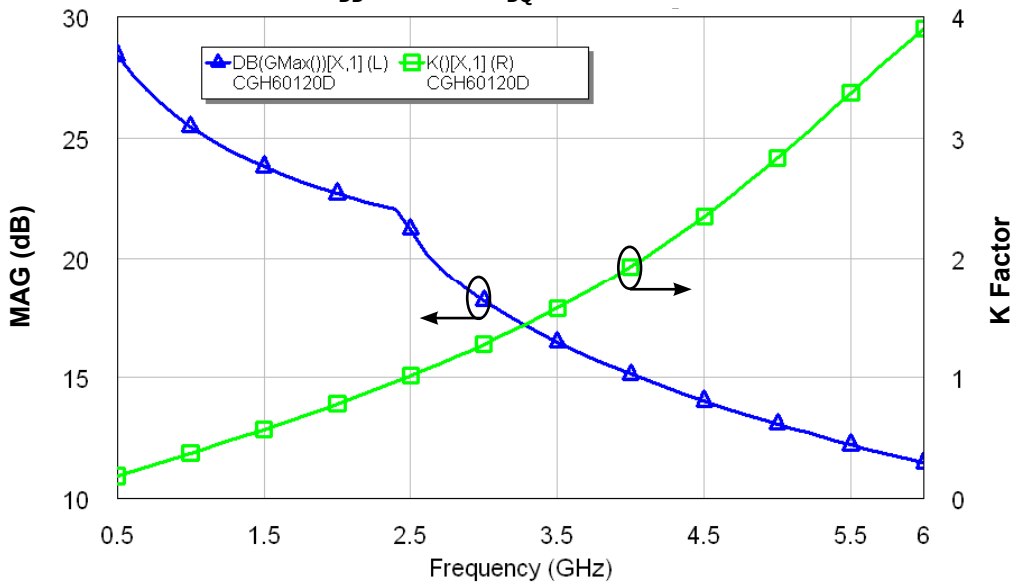
## Typical Performance

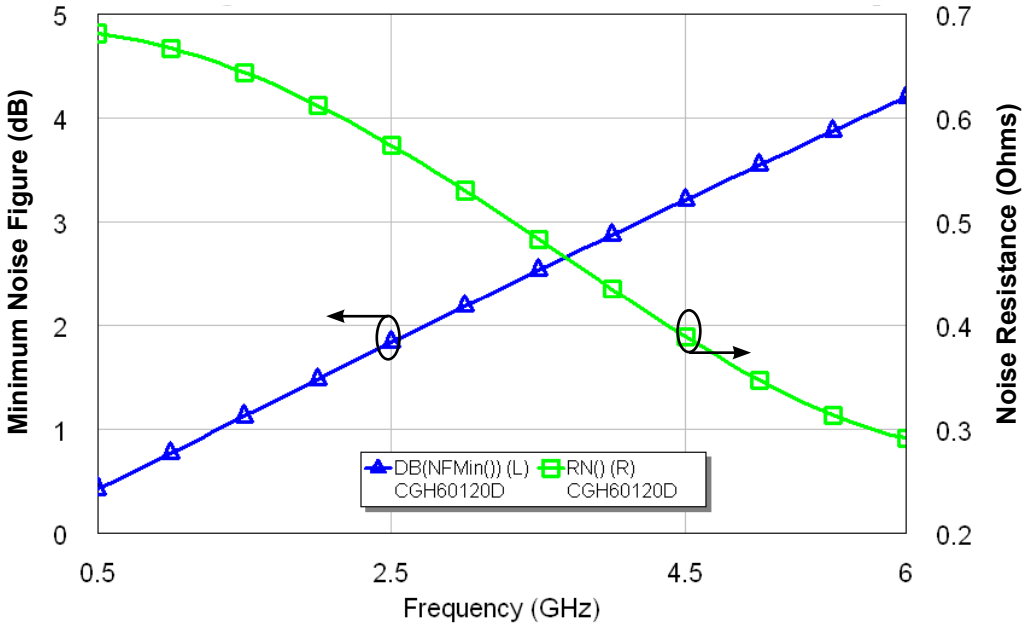
**Simulated Maximum Available Gain and K Factor of the CGH60120D**
**$V_{DD}$ = 28 V, $I_{DQ}$ = 1000 mA**




Intrinsic die parameters - reference planes at centers of gate and drain bonding pads. No wire bonds assumed.

## Typical Noise Performance

**Simulated Minimum Noise Figure and Noise Resistance vs Frequency of the CGH60120D**
**$V_{DD}$ = 28 V, $I_{DQ}$ = 1000 mA**

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## Typical Die S-Parameters (Small Signal, $V_{DS}$ = 28 V, $I_{DQ}$ = 500 mA, magnitude / angle)

| Frequency | Mag S11 | Ang S11 | Mag S21 | Ang S21 | Mag S12 | Ang S12 | Mag S22 | Ang S22 |
|---|---|---|---|---|---|---|---|---|
| 500 MHz | 0.961 | -174.70 | 4.32 | 82.44 | 0.008 | -5.29 | 0.780 | -176.07 |
| 600 MHz | 0.962 | -175.52 | 3.58 | 80.05 | 0.008 | -7.21 | 0.783 | -175.85 |
| 700 MHz | 0.962 | -176.10 | 3.05 | 77.81 | 0.008 | -8.99 | 0.786 | -175.58 |
| 800 MHz | 0.962 | -176.53 | 2.65 | 75.66 | 0.008 | -10.67 | 0.790 | -175.30 |
| 900 MHz | 0.963 | -176.86 | 2.34 | 73.59 | 0.008 | -12.27 | 0.794 | -175.02 |
| 1.0 GHz | 0.963 | -177.12 | 2.08 | 71.58 | 0.008 | -13.80 | 0.798 | -174.74 |
| 1.1 GHz | 0.964 | -177.33 | 1.88 | 69.64 | 0.008 | -15.27 | 0.802 | -174.48 |
| 1.2 GHz | 0.964 | -177.50 | 1.70 | 67.75 | 0.008 | -16.68 | 0.807 | -174.24 |
| 1.3 GHz | 0.965 | -177.65 | 1.55 | 65.90 | 0.008 | -18.04 | 0.812 | -174.02 |
| 1.4 GHz | 0.965 | -177.78 | 1.43 | 64.11 | 0.007 | -19.34 | 0.817 | -173.82 |
| 1.5 GHz | 0.966 | -177.89 | 1.31 | 62.37 | 0.007 | -20.60 | 0.822 | -173.64 |
| 1.6 GHz | 0.967 | -177.99 | 1.22 | 60.67 | 0.007 | -21.80 | 0.827 | -173.49 |
| 1.7 GHz | 0.967 | -178.08 | 1.13 | 59.02 | 0.007 | -22.95 | 0.832 | -173.35 |
| 1.8 GHz | 0.968 | -178.16 | 1.05 | 57.41 | 0.007 | -24.04 | 0.837 | -173.24 |
| 1.9 GHz | 0.968 | -178.24 | 0.98 | 55.85 | 0.007 | -25.09 | 0.842 | -173.15 |
| 2.0 GHz | 0.969 | -178.31 | 0.92 | 54.33 | 0.007 | -26.08 | 0.847 | -173.07 |
| 2.1 GHz | 0.970 | -178.37 | 0.86 | 52.85 | 0.006 | -27.03 | 0.851 | -173.01 |
| 2.2 GHz | 0.970 | -178.43 | 0.81 | 51.42 | 0.006 | -27.92 | 0.856 | -172.97 |
| 2.3 GHz | 0.971 | -178.49 | 0.77 | 50.02 | 0.006 | -28.76 | 0.861 | -172.95 |
| 2.4 GHz | 0.971 | -178.55 | 0.72 | 48.67 | 0.006 | -29.56 | 0.865 | -172.93 |
| 2.5 GHz | 0.972 | -178.60 | 0.68 | 47.36 | 0.006 | -30.30 | 0.870 | -172.93 |
| 2.6 GHz | 0.973 | -178.66 | 0.65 | 46.08 | 0.006 | -31.00 | 0.874 | -172.94 |
| 2.7 GHz | 0.973 | -178.71 | 0.61 | 44.84 | 0.006 | -31.64 | 0.878 | -172.97 |
| 2.8 GHz | 0.974 | -178.76 | 0.58 | 43.64 | 0.005 | -32.24 | 0.882 | -173.00 |
| 2.9 GHz | 0.974 | -178.81 | 0.55 | 42.47 | 0.005 | -32.78 | 0.886 | -173.03 |
| 3.0 GHz | 0.975 | -178.85 | 0.53 | 41.34 | 0.005 | -33.28 | 0.890 | -173.08 |
| 3.2 GHz | 0.975 | -178.95 | 0.48 | 39.17 | 0.005 | -34.13 | 0.897 | -173.19 |
| 3.4 GHz | 0.976 | -179.03 | 0.44 | 37.12 | 0.005 | -34.78 | 0.903 | -173.32 |
| 3.6 GHz | 0.977 | -179.12 | 0.40 | 35.19 | 0.004 | -35.24 | 0.909 | -173.46 |
| 3.8 GHz | 0.978 | -179.20 | 0.37 | 33.37 | 0.004 | -35.48 | 0.915 | -173.62 |
| 4.0 GHz | 0.979 | -179.29 | 0.34 | 31.64 | 0.004 | -35.52 | 0.920 | -173.78 |
| 4.2 GHz | 0.979 | -179.37 | 0.31 | 30.01 | 0.004 | -35.32 | 0.925 | -173.95 |
| 4.4 GHz | 0.980 | -179.44 | 0.29 | 28.46 | 0.003 | -34.89 | 0.929 | -174.12 |
| 4.6 GHz | 0.980 | -179.52 | 0.27 | 27.00 | 0.003 | -34.19 | 0.933 | -174.29 |
| 4.8 GHz | 0.981 | -179.60 | 0.25 | 25.61 | 0.003 | -33.22 | 0.937 | -174.46 |
| 5.0 GHz | 0.981 | -179.67 | 0.24 | 24.29 | 0.003 | -31.92 | 0.941 | -174.63 |
| 5.2 GHz | 0.982 | -179.74 | 0.22 | 23.03 | 0.003 | -30.27 | 0.944 | -174.80 |
| 5.4 GHz | 0.982 | -179.81 | 0.21 | 21.84 | 0.002 | -28.22 | 0.947 | -174.97 |
| 5.6 GHz | 0.982 | -179.88 | 0.19 | 20.70 | 0.002 | -25.72 | 0.950 | -175.13 |
| 5.8 GHz | 0.983 | -179.95 | 0.18 | 19.61 | 0.002 | -22.72 | 0.952 | -175.29 |
| 6.0 GHz | 0.983 | 179.98 | 0.17 | 18.58 | 0.002 | -19.15 | 0.954 | -175.45 |

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## Typical Die S-Parameters (Small Signal, $V_{DS}$ = 28 V, $I_{DQ}$ = 1.0 A, magnitude / angle)

| Frequency | Mag S11 | Ang S11 | Mag S21 | Ang S21 | Mag S12 | Ang S12 | Mag S22 | Ang S22 |
|---|---|---|---|---|---|---|---|---|
| 500 MHz | 0.969 | -175.20 | 4.23 | 83.99 | 0.006 | -3.13 | 0.817 | -177.45 |
| 600 MHz | 0.969 | -175.97 | 3.51 | 81.96 | 0.006 | -4.57 | 0.818 | -177.31 |
| 700 MHz | 0.969 | -176.53 | 3.00 | 80.05 | 0.006 | -5.88 | 0.820 | -177.14 |
| 800 MHz | 0.970 | -176.94 | 2.61 | 78.23 | 0.006 | -7.11 | 0.822 | -176.95 |
| 900 MHz | 0.970 | -177.26 | 2.31 | 76.46 | 0.006 | -8.27 | 0.824 | -176.75 |
| 1.0 GHz | 0.970 | -177.51 | 2.06 | 74.75 | 0.006 | -9.38 | 0.827 | -176.55 |
| 1.1 GHz | 0.970 | -177.72 | 1.86 | 73.08 | 0.006 | -10.44 | 0.829 | -176.35 |
| 1.2 GHz | 0.971 | -177.90 | 1.70 | 71.45 | 0.006 | -11.46 | 0.832 | -176.16 |
| 1.3 GHz | 0.971 | -178.04 | 1.55 | 69.85 | 0.006 | -12.44 | 0.835 | -175.98 |
| 1.4 GHz | 0.971 | -178.17 | 1.43 | 68.28 | 0.006 | -13.37 | 0.838 | -175.81 |
| 1.5 GHz | 0.971 | -178.28 | 1.32 | 66.75 | 0.006 | -14.27 | 0.841 | -175.65 |
| 1.6 GHz | 0.972 | -178.38 | 1.23 | 65.25 | 0.005 | -15.13 | 0.844 | -175.50 |
| 1.7 GHz | 0.972 | -178.47 | 1.15 | 63.78 | 0.005 | -15.95 | 0.847 | -175.36 |
| 1.8 GHz | 0.972 | -178.55 | 1.07 | 62.33 | 0.005 | -16.73 | 0.850 | -175.24 |
| 1.9 GHz | 0.973 | -178.62 | 1.01 | 60.92 | 0.005 | -17.47 | 0.854 | -175.13 |
| 2.0 GHz | 0.973 | -178.69 | 0.95 | 59.54 | 0.005 | -18.17 | 0.857 | -175.03 |
| 2.1 GHz | 0.974 | -178.75 | 0.89 | 58.19 | 0.005 | -18.82 | 0.860 | -174.94 |
| 2.2 GHz | 0.974 | -178.81 | 0.84 | 56.87 | 0.005 | -19.44 | 0.864 | -174.86 |
| 2.3 GHz | 0.974 | -178.86 | 0.80 | 55.57 | 0.005 | -20.01 | 0.867 | -174.80 |
| 2.4 GHz | 0.975 | -178.91 | 0.75 | 54.31 | 0.005 | -20.54 | 0.870 | -174.74 |
| 2.5 GHz | 0.975 | -178.96 | 0.72 | 53.07 | 0.005 | -21.02 | 0.873 | -174.69 |
| 2.6 GHz | 0.975 | -179.01 | 0.68 | 51.86 | 0.005 | -21.46 | 0.876 | -174.66 |
| 2.7 GHz | 0.976 | -179.05 | 0.65 | 50.68 | 0.004 | -21.86 | 0.880 | -174.63 |
| 2.8 GHz | 0.976 | -179.10 | 0.62 | 49.53 | 0.004 | -22.20 | 0.883 | -174.61 |
| 2.9 GHz | 0.976 | -179.14 | 0.59 | 48.40 | 0.004 | -22.50 | 0.886 | -174.59 |
| 3.0 GHz | 0.977 | -179.18 | 0.56 | 47.30 | 0.004 | -22.75 | 0.889 | -174.59 |
| 3.2 GHz | 0.977 | -179.26 | 0.51 | 45.17 | 0.004 | -23.11 | 0.894 | -174.60 |
| 3.4 GHz | 0.978 | -179.34 | 0.47 | 43.14 | 0.004 | -23.25 | 0.900 | -174.63 |
| 3.6 GHz | 0.978 | -179.41 | 0.43 | 41.20 | 0.004 | -23.18 | 0.905 | -174.68 |
| 3.8 GHz | 0.979 | -179.49 | 0.40 | 39.36 | 0.003 | -22.87 | 0.910 | -174.74 |
| 4.0 GHz | 0.979 | -179.56 | 0.37 | 37.60 | 0.003 | -22.32 | 0.915 | -174.82 |
| 4.2 GHz | 0.980 | -179.62 | 0.35 | 35.92 | 0.003 | -21.50 | 0.919 | -174.91 |
| 4.4 GHz | 0.980 | -179.69 | 0.32 | 34.31 | 0.003 | -20.40 | 0.923 | -175.00 |
| 4.6 GHz | 0.981 | -179.76 | 0.30 | 32.78 | 0.003 | -18.98 | 0.927 | -175.11 |
| 4.8 GHz | 0.981 | -179.82 | 0.28 | 31.32 | 0.003 | -17.23 | 0.930 | -175.22 |
| 5.0 GHz | 0.982 | -179.89 | 0.26 | 29.92 | 0.002 | -15.11 | 0.934 | -175.33 |
| 5.2 GHz | 0.982 | -179.95 | 0.25 | 28.58 | 0.002 | -12.59 | 0.937 | -175.45 |
| 5.4 GHz | 0.982 | 179.99 | 0.23 | 27.30 | 0.002 | -9.66 | 0.940 | -175.57 |
| 5.6 GHz | 0.983 | 179.93 | 0.22 | 26.08 | 0.002 | -6.29 | 0.943 | -175.69 |
| 5.8 GHz | 0.983 | 179.86 | 0.21 | 24.90 | 0.002 | -2.48 | 0.945 | -175.81 |
| 6.0 GHz | 0.983 | 179.80 | 0.20 | 23.78 | 0.002 | 1.75 | 0.948 | -175.93 |

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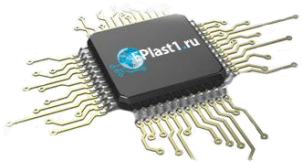
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.




**Как с нами связаться**

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