# BCG004

## 4W GaN Power Transistor

### 4W GaN Power Transistor (0.15µm x 960µm gate)

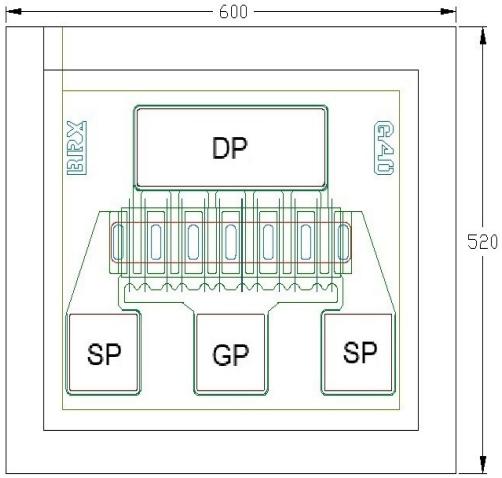
The BeRex BCG004 is a GaN Power HEMT die with a nominal 0.15 micron gate length and 960 micron gate width making the product ideally suited for amplifier applications where high-gain and high power from DC to 26 GHz. The product may be used in either wide-band or narrow-band applications. The BCG004 is produced using state of the art metallization with SI3N4 passivation and is screened to assure reliability.

### Product Features

- 36.5 dBm Typical Saturated Output Power (P3dB) @ 12 GHz
- 10.5 dB Typical Saturated gain (G3dB) @ 12 GHz
- 55 % PAE Typical @ 12 GHz
- 0.15 X 960 Micron Recessed Gate

### Applications

- Commercial
- Military / Hi-Rel.
- Test & Measurement




Chip dimensions : 600 X 520 microns
Gate pad(GP) : 90 X 90 microns
Drain pad(DP) : 250 X 90 microns
Source pad(SP) : 90 X 90 microns
Chip thickness : 75 microns

### Typical Performance

| SYMBOLS | PARAMETER/TEST CONDITIONS | TEST FRE-QUENCY | MIN. | TYPICAL | Max | UNIT |
|---|---|---|---|---|---|---|
| P3dB | Saturated Output Power @ P3dB (Vds = 28V, Id = 40mA) | 12 GHz | 35 | 36.5 | | dBm |
| G3dB | Power Gain @ P3dB (Vds = 28V, Id = 40mA) | 12 GHz | 9.0 | 10.5 | | dB |
| PAE | PAE @ P3dB (Vds = 28V, Id = 40mA) | 12 GHz | | 55 | | % |
| $I_{dss}$ | Saturated Drain Current ($V_{gs}$ = 0.0 V, $V_{ds}$ = 10.0 V) | | 420 | 520 | 620 | mA |
| $V_p$ | Pinch-off Voltage ($I_{ds}$ = 0.96 mA, $V_{ds}$ = 10 V) | | | -1.9 | | V |
| $BV_{gd}$ | Drain Breakdown Voltage ($I_g$ = 0.96 mA, source open) | | | 84 | | V |
| $BV_{gs}$ | Source Breakdown Voltage ($I_g$ = 0.96 mA, drain open) | | | -6.5 | | V |
| $R_{th}$ | Thermal Resistance | | | 5.8 | | ° C/W |




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## MAXIMUM RATING (Ta = 25° C)

| SYMBOLS | PARAMETERS | ABSOLUTE |
|---|---|---|
| $V_{ds}$ | Drain-Source Voltage | 90 V |
| $V_{gs}$ | Gate-Source Voltage | -10 V |
| $I_{ds}$ | Drain Current | 1.2 A |
| $I_{gsf}$ | Forward Gate Current | 2 mA |
| $T_{stg}$ | Storage Temperature | -60° C to 150° C |
| $P_t$ | Total Power Dissipation | 7.5 W |

Exceeding any of the above Maximum Ratings will result in reduced MTTF and may cause permanent damage to the device.

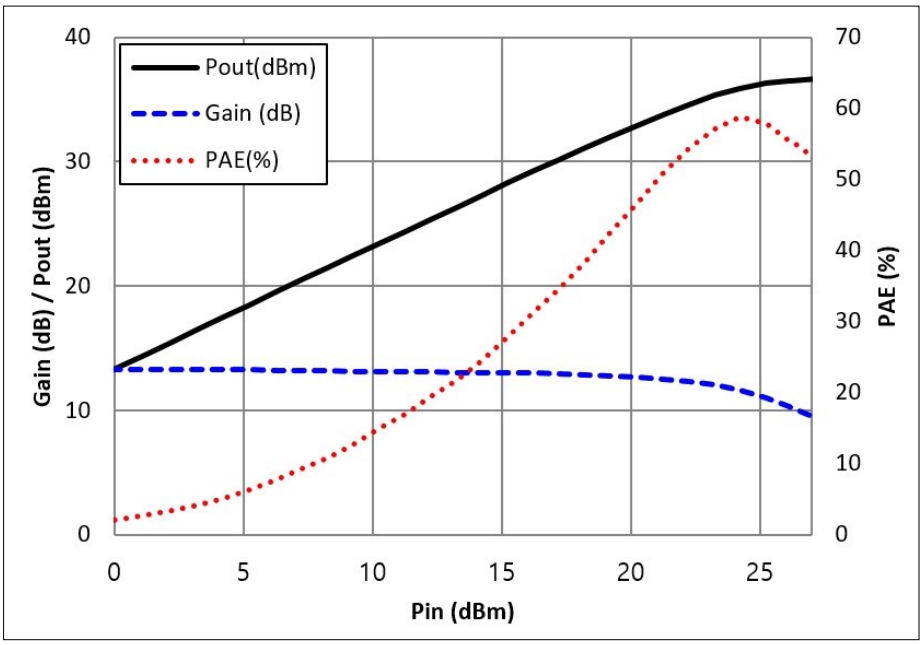
## S-PARAMETERS (Vds = 28V, Ids = 40mA, T = 25℃)

| FREQ. [GHZ] | S11 [MAG] | S11 [ANG.] | S21 [MAG] | S21 [ANG.] | S12 [MAG] | S12 [ANG.] | S22 [MAG] | S22 [ANG.] |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.84 | -76.84 | 14.82 | 131.66 | 0.046 | 46.72 | 0.52 | -50.02 |
| 2 | 0.72 | -122.16 | 9.84 | 105.90 | 0.056 | 33.72 | 0.39 | -75.13 |
| 3 | 0.68 | -152.17 | 7.19 | 89.22 | 0.066 | 25.54 | 0.33 | -90.13 |
| 4 | 0.67 | -172.79 | 5.57 | 75.78 | 0.067 | 23.15 | 0.31 | -99.09 |
| 5 | 0.68 | 168.98 | 4.47 | 64.72 | 0.067 | 22.16 | 0.29 | -108.09 |
| 6 | 0.69 | 154.48 | 3.70 | 54.68 | 0.070 | 21.64 | 0.30 | -115.42 |
| 7 | 0.71 | 139.52 | 3.13 | 44.72 | 0.069 | 21.98 | 0.29 | -123.06 |
| 8 | 0.74 | 128.59 | 2.65 | 36.12 | 0.073 | 23.85 | 0.30 | -128.86 |
| 9 | 0.77 | 118.86 | 2.29 | 27.40 | 0.077 | 20.47 | 0.31 | -135.56 |
| 10 | 0.79 | 111.57 | 1.98 | 20.42 | 0.078 | 18.77 | 0.32 | -142.34 |
| 11 | 0.82 | 104.49 | 1.71 | 12.55 | 0.079 | 18.91 | 0.34 | -149.87 |
| 12 | 0.86 | 99.98 | 1.50 | 6.45 | 0.083 | 23.18 | 0.35 | -158.20 |
| 13 | 0.86 | 95.03 | 1.32 | 0.40 | 0.082 | 19.05 | 0.37 | -162.83 |
| 14 | 0.88 | 90.91 | 1.17 | -5.63 | 0.085 | 16.65 | 0.39 | -168.64 |
| 15 | 0.90 | 88.25 | 1.06 | -10.44 | 0.088 | 14.96 | 0.43 | -175.17 |
| 16 | 0.90 | 87.19 | 0.95 | -14.92 | 0.092 | 16.71 | 0.45 | -179.70 |
| 17 | 0.92 | 85.63 | 0.87 | -19.11 | 0.097 | 18.29 | 0.48 | 175.97 |
| 18 | 0.92 | 84.56 | 0.78 | -22.59 | 0.096 | 14.36 | 0.50 | 173.85 |
| 19 | 0.91 | 83.68 | 0.72 | -25.74 | 0.108 | 13.64 | 0.53 | 171.12 |
| 20 | 0.92 | 82.23 | 0.65 | -29.03 | 0.111 | 15.54 | 0.56 | 167.25 |
| 21 | 0.91 | 78.12 | 0.62 | -32.63 | 0.122 | 12.60 | 0.57 | 165.37 |
| 22 | 0.90 | 73.90 | 0.59 | -36.07 | 0.128 | 10.47 | 0.59 | 162.82 |
| 23 | 0.88 | 70.62 | 0.54 | -40.79 | 0.135 | 6.01 | 0.60 | 158.74 |
| 24 | 0.87 | 67.28 | 0.49 | -43.25 | 0.145 | 4.01 | 0.59 | 154.81 |
| 25 | 0.89 | 64.44 | 0.46 | -45.77 | 0.143 | 5.40 | 0.59 | 153.48 |
| 26 | 0.91 | 61.26 | 0.43 | -47.46 | 0.148 | 4.36 | 0.62 | 148.75 |



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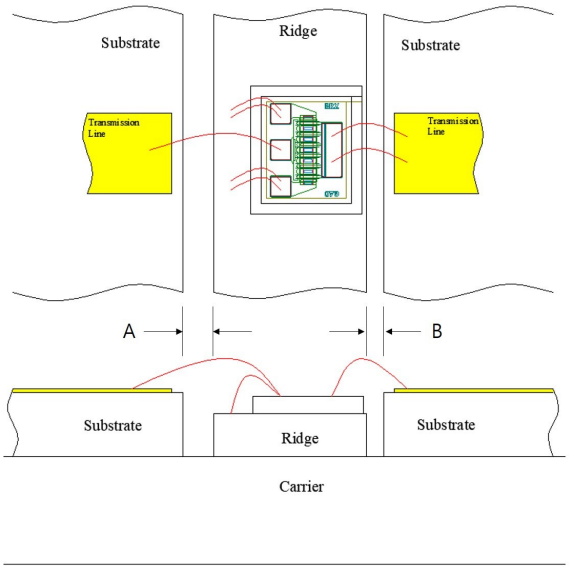
### PIN_POUT / Gain, PAE (@ 12 GHz)




(Vds = 28V, Idq = 40mA, T = 25 ℃)

### WIRE BONDING INFORMATION

Always follow wire bonding diagrams recommended by BeRex for each device to achieve optimum device performance and reliability. As a general rule, bonding temperature should be kept to a maximum of 280°C for no longer than 2 minutes for all bonding wires.




Using 1 mil. Diameter, Au bonding wires.

1. Gate to input transmission line
- Length and Height : 900 µm x 250 µm
- Number of wire(s): 1

2. Drain to output transmission line
- Length and Height : 400 µm x 250 µm
- Number of wire(s) : 2

3. Source to ground plate
- Length and Height : 250 µm x 300 µm
- Number of wire(s) : 4

4. Gap “A” : 230 ~ 250 um

5. Gap “B” : 130 ~ 150 um



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## ESD Rating

| ESD Testing Mode | Reference (Current Revision) | Resulting Classification |
|---|---|---|
| ESD - HBM | JDS - 001 - 2017 | Class1A (Passes <500V) |




Proper ESD procedures should be followed when handling this device.

## HANDLING PRECAUTIONS

GaN HEMTs are very sensitive to and may be damaged by Electrostatic Discharge (ESD). Therefore, proper ESD precautions must be taken whenever you are handling these devices. It is critically important that all work surfaces, and assembly equipment, as well as the operator be properly grounded when handling these devices to prevent ESD damage.

## DIE ATTACH RECOMMENDATIONS

BeRex recommends the "Eutectic" die attach using Au/Sn (80/20) pre-forms. The die attach station must have accurate temperature control, and the operation should be performed with parts no hotter than 300°C for less than 10 seconds. An inert forming gas (90% $N_2$/10% $H_2$) or clean, dry $N_2$ should be used.

Use of conductive epoxy (gold or silver filled) may also be acceptable for die-attaching low power devices.

## SHIPPING & STORAGE

BeRex's standard chip device shipping package consists of an antistatic "Gel-Pak", holding the chips, placed inside a sealed metallized bag. This packaging is designed to provide a reasonable measure of protection from both mechanical and ESD damage.

Chip devices should be stored in a clean, dry Nitrogen gas environment at room temperature until they are required for assembly. Only open the shipping package or perform die assembly in a work area with a class 10,000 or better clean room environment to prevent contamination of the exposed devices.



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## CAUTION

THIS PRODUCT CONTAINS GALLIUM NITRIDE (GaN) ON SILICON CARBIDE (SIC) WHICH CAN BE HAZARDOUS TO THE HUMAN BODY AND THE ENVIRONMENT. THEREFORE, IT MUST BE HANDLED WITH CARE AND IN ACCORDANCE WITH ALL GOVERNMENTAL AND COMPANY REGULATIONS FOR THE SAFE HANDLING AND DISPOSAL OF HAZARDOUS WASTE. DO NOT BURN, DESTROY, CUT, CRUSH OR CHEMICALLY DISSOLVE THE PRODUCT. DO NOT LICK THE PRODUCT OR IN ANY WAY ALLOW IT TO ENTER THE MOUTH. EXCLUDE THE PRODUCT FROM GENERAL INDUSTRIAL WASTE OR GARBAGE AND DISPOSE OF ONLY IN ACCORDANCE TO APPLICABLE LAWS AND/OR ORDINANCES.

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