# BCP120C

## HIGH EFFICIENCY HETEROJUNCTION POWER FET CHIP (.25µm x 1200µm)

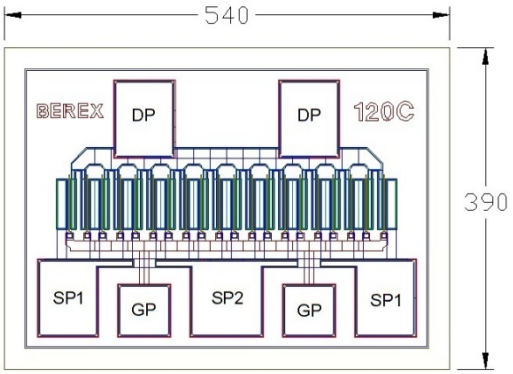
The BeRex BCP120C is a GaAs Power pHEMT with a nominal 0.25-micron by 1200-micron gate making this product ideally suited for applications where high-gain and medium power in the DC to 26.5 GHz frequency range are required. The product may be used in either wideband (6-18 GHz) or narrow-band applications. The BCP120C is produced using state of the art metallization with $SI_3N_4$ passivation and is screened to assure reliability.

### PRODUCT FEATURES

- 30.5 dBm Typical Output Power
- 11 dB Typical Gain @ 12 GHz
- 0.25 X 1200 Micron Recessed Gate

### APPLICATIONS

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




Chip dimensions : 540 X 390 microns
Gate pad(GP) : 60 X 60 microns
Drain pad(DP) : 70 X 90 microns
Source pad1(SP1) : 70 X 90 microns
Source pad2(SP2) : 80 X 90 microns
Chip thickness : 75 microns

### ELECTRICAL CHARACTERISTIC (TUNED FOR POWER) $T_a$ = 25° C

| PARAMETER/TEST CONDITIONS | | TEST FREQ. | MIN. | TYPICAL | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $P_{1dB}$ | Output Power @ $P_{1dB}$ ($V_{ds}$ = 8V, $I_d$ = 180mA) | 12 GHZ<br>18 GHz | 29.0<br>28.0 | 30.5<br>29.5 | | dBm |
| $G_{1dB}$ | Gain @ $P_{1dB}$ ($V_{ds}$ = 8V, $I_d$ = 180mA) | 12 GHZ<br>18 GHz | 9.5<br>6.5 | 11.0<br>8.0 | | dB |
| PAE | PAE @ $P_{1dB}$ ($V_{ds}$ = 8V, $I_d$ = 180mA) | 12 GHZ<br>18 GHz | | 60<br>45 | | % |
| $I_{dss}$ | Saturated Drain Current ($V_{gs}$ = 0V, $I_d$ = 1.0V) | | 260 | 380 | 500 | mA |
| $G_m$ | Transconductance ($V_{ds}$ = 2V, Vgs = 180mA) | | | 470 | | mS |
| $V_p$ | Pinch-off Voltage ($I_d$ = 1.2mA, $V_{ds}$ = 2V) | | -2.5 | -1.2 | | V |
| $BV_{gd}$ | Drain Breakdown Voltage ($I_{gd}$ = 1.2mA, source open) | | | -15 | -12 | V |
| $BV_{gs}$ | Source Breakdown Voltage ($I_g$ = 1.2mA, drain open) | | | -13 | | V |
| $R_{th}$ | Thermal Resistance (Au-Sn Eutectic Attach) | | | 37 | | °C/W |



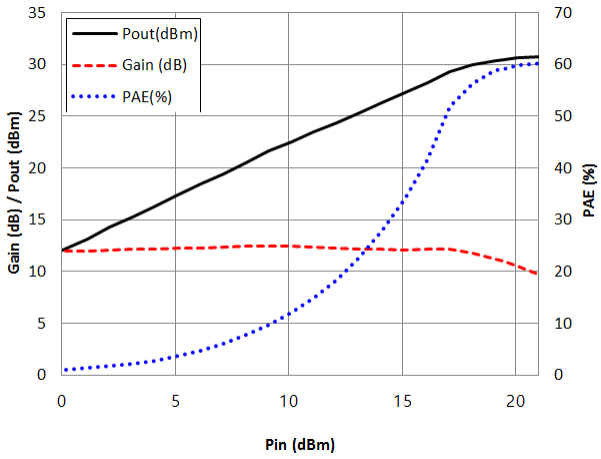
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## MAXIMUM RATING ($T_a$ = 25° C)

| PARAMETERS | | ABSOLUTE | CONTINUOUS |
|---|---|---|---|
| $V_{ds}$ | Drain-Source Voltage | 12V | 8 V |
| $V_{gs}$ | Gate-Source Voltage | -6V | -3 V |
| $I_d$ | Drain Current | $I_{dss}$ | $I_{dss}$ |
| $I_{gsf}$ | Forward Gate Current | 60 mA | 10 mA |
| $P_{in}$ | Input Power | 29 dBm | @ 3 dB compression |
| $T_{ch}$ | Channel Temperature | 175°C | 150°C |
| $T_{stg}$ | Storage Temperature | -60°C ~ 150°C | -60°C ~ 150°C |
| $P_t$ | Total Power Dissipation | 4.1 W | 3.4 W |

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

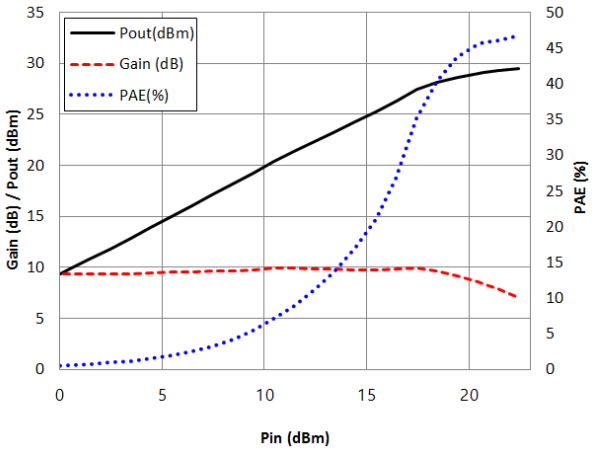
### $P_{IN}$_$P_{OUT}$/Gain, PAE (12 GHz)




Frequency = 12 GHz

$V_{ds}$ = 8V, $I_{ds}$ = 180mA (Tuned for Power)

### $P_{IN}$_$P_{OUT}$/Gain, PAE (18 GHz)




Frequency = 18 GHz

$V_{ds}$ = 8V, $I_{ds}$ = 180mA (Tuned for Power)



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**S-PARAMETERS ($V_{ds}$ = 8V, $I_{ds}$ = 180mA)**

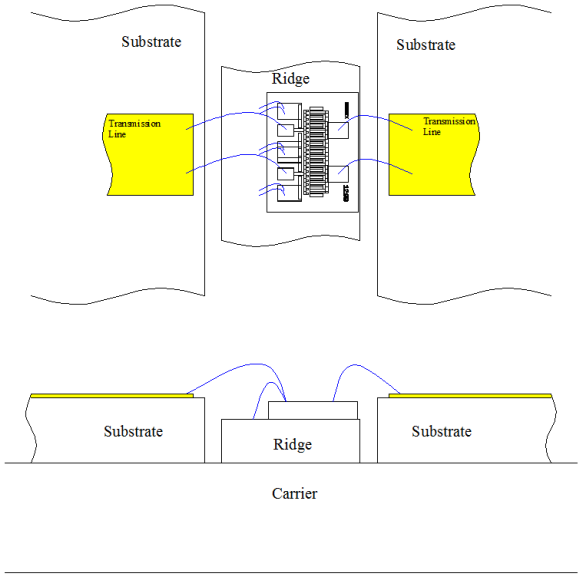
| FREQ. [GHZ] | S11 [MAG] | S11 [ANG.] | S21 [MAG] | S21 [ANG.] | S12 [MAG] | S12 [ANG.] | S22 [MAG] | S22 [ANG.] |
|---|---|---|---|---|---|---|---|---|
| 1.0 | 0.89 | -96.37 | 14.58 | 124.56 | 0.031 | 41.61 | 0.32 | -59.57 |
| 2.0 | 0.86 | -135.03 | 8.94 | 101.11 | 0.037 | 28.72 | 0.26 | -84.06 |
| 3.0 | 0.85 | -154.35 | 6.30 | 87.04 | 0.039 | 24.32 | 0.25 | -96.48 |
| 4.0 | 0.85 | -166.92 | 4.82 | 76.51 | 0.039 | 23.30 | 0.25 | -104.53 |
| 5.0 | 0.85 | -176.70 | 3.89 | 67.06 | 0.039 | 25.12 | 0.26 | -110.74 |
| 6.0 | 0.86 | 175.03 | 3.24 | 58.26 | 0.041 | 25.20 | 0.29 | -116.71 |
| 7.0 | 0.86 | 167.52 | 2.76 | 50.23 | 0.040 | 28.71 | 0.31 | -122.84 |
| 8.0 | 0.87 | 161.16 | 2.39 | 42.43 | 0.040 | 29.58 | 0.33 | -128.07 |
| 9.0 | 0.88 | 155.07 | 2.08 | 34.71 | 0.040 | 30.55 | 0.36 | -133.66 |
| 10.0 | 0.89 | 149.79 | 1.83 | 27.63 | 0.040 | 31.41 | 0.39 | -138.71 |
| 11.0 | 0.89 | 145.66 | 1.61 | 21.04 | 0.043 | 34.48 | 0.42 | -145.31 |
| 12.0 | 0.90 | 141.61 | 1.42 | 14.39 | 0.044 | 36.56 | 0.45 | -150.89 |
| 13.0 | 0.91 | 138.47 | 1.27 | 8.44 | 0.045 | 37.21 | 0.49 | -156.42 |
| 14.0 | 0.92 | 135.64 | 1.13 | 2.84 | 0.046 | 35.22 | 0.52 | -161.10 |
| 15.0 | 0.93 | 132.70 | 1.02 | -2.73 | 0.050 | 36.77 | 0.56 | -165.49 |
| 16.0 | 0.93 | 130.92 | 0.92 | -7.66 | 0.051 | 36.01 | 0.59 | -169.36 |
| 17.0 | 0.94 | 129.56 | 0.83 | -12.31 | 0.056 | 36.28 | 0.63 | -172.90 |
| 18.0 | 0.94 | 126.87 | 0.77 | -17.21 | 0.055 | 33.51 | 0.66 | -176.39 |
| 19.0 | 0.94 | 125.28 | 0.70 | -21.95 | 0.059 | 34.15 | 0.69 | -179.10 |
| 20.0 | 0.94 | 122.60 | 0.64 | -26.82 | 0.058 | 32.57 | 0.72 | 178.04 |
| 21.0 | 0.93 | 121.02 | 0.58 | -30.45 | 0.064 | 31.89 | 0.75 | 175.64 |
| 22.0 | 0.92 | 118.80 | 0.54 | -34.76 | 0.067 | 30.36 | 0.78 | 173.29 |
| 23.0 | 0.91 | 115.04 | 0.50 | -39.90 | 0.076 | 28.09 | 0.79 | 170.43 |
| 24.0 | 0.91 | 111.50 | 0.46 | -44.45 | 0.076 | 23.74 | 0.81 | 167.25 |
| 25.0 | 0.90 | 107.90 | 0.41 | -49.08 | 0.078 | 23.62 | 0.81 | 163.82 |
| 26.0 | 0.91 | 101.67 | 0.37 | -52.23 | 0.079 | 21.55 | 0.81 | 160.37 |

Note: S-parameters include bond wires. Reference planes are at edge of substrates shown on “Wire Bonding Information” figure below.



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## WIRE BONDING INFORMATION




Using 1 mil. diameter, Au bonding wires.

1. Gate to input transmission line
   - Length and Height : 600 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) : 1
3. Source to ground plate
   - Length and Height : 250 µm x 300 µm
   - Number of wire(s) : 4




Proper ESD procedures should be followed when handling this device.



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**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 60 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.

**HANDLING PRECAUTIONS:**

GaAs FETs 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.

**STORAGE & SHIPPING:**

The BeRex standard chip device shipping package consists of an antistatic "Gel-Pak", holding the chips, placed inside a sealed antistatic and moisture barrier 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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