# BCP080T2

## HIGH EFFICIENCY HETEROJUNCTION POWER FET CHIP (.25µm x 800µm)

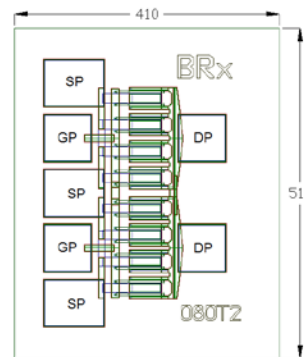
The BeRex BCP080T2 is a GaAs Power pHEMT with a nominal 0.25 micron gate length and 800 micron gate width making it ideally suited for applications requiring high-gain and medium power in the 1000 MHz to 27.5 GHz frequency range. The product may be used in either wideband (6-18 GHz) or narrow-band applications. The BCP080T2 is produced using state of the art metallization with $SI_3N_4$ passivation and is screened to assure reliability.

## PRODUCT FEATURES

- 30 dBm Typical Output Power
- 11.5 dB Typical Power Gain @ 12 GHz
- 0.25 X 800 Micron Recessed Gate
- 2 Gate Pads / 2 Drain Pads

## APPLICATIONS

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




Chip dimensions : 410 X 510 microns
Gate pad(GP) : 75 X 75 microns
Drain pad(DP) : 75 X 75 microns
Source pad(SP) : 95 X 75 microns
Chip thickness : 100 microns

## DC CHARACTERISTICS $T_a$ = 25° C

| SYMBOL | PARAMETER/TEST CONDITIONS | MIN. | TYPICAL | MAX. | UNIT |
|---|---|---|---|---|---|
| $I_{dss}$ | Saturated Drain Current ($V_{gs}$ = 0V, $V_{ds}$ = 1.0V) | 160 | 240 | 320 | mA |
| $G_m$ | Transconductance ($V_{ds}$ = 3V, $V_{gs}$ = 50% $I_{dss}$) | | 320 | | mS |
| $V_p$ | Pinch-off Voltage ($I_{ds}$ = 800 µA, $V_{ds}$ = 2V) | -2.5 | -1.1 | -0.5 | V |
| $BV_{gd}$ | Drain Breakdown Voltage ($I_{gd}$ = 0.8 mA, source open) | | -16 | -12 | V |
| $BV_{gs}$ | Source Breakdown Voltage ($I_g$ = 0.8 mA, drain open) | | -14 | | V |
| $R_{th}$ | Thermal Resistance (Au-Sn Eutectic Attach) | | 55 | | °C/W |

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

| SYMBOL | PARAMETER/TEST CONDITIONS | TEST FREQ. | MIN. | TYPICAL | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $P_{1dB}$ | Output Power @ $P_{1dB}$ ($V_{ds}$ = 8V, $I_{ds}$ = 50% $I_{dss}$) | 12 GHz<br>18 GHz | 28.5<br>28.0 | 30.0<br>29.5 | | dBm |
| $G_{1dB}$ | Gain @ $P_{1dB}$ ($V_{ds}$ = 8V, $I_{ds}$ = 50% $I_{dss}$) | 12 GHz<br>18 GHz | 10.5<br>8.5 | 11.5<br>9.5 | | dB |
| PAE | PAE @ $P_{1dB}$ ($V_{ds}$ = 8V, $I_{ds}$ = 50% $I_{dss}$) | 12 GHz<br>18 GHz | | 65<br>60 | | % |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## ELECTRICAL CHARACTERISTIC (TUNED FOR GAIN) $T_a$ = 25° C

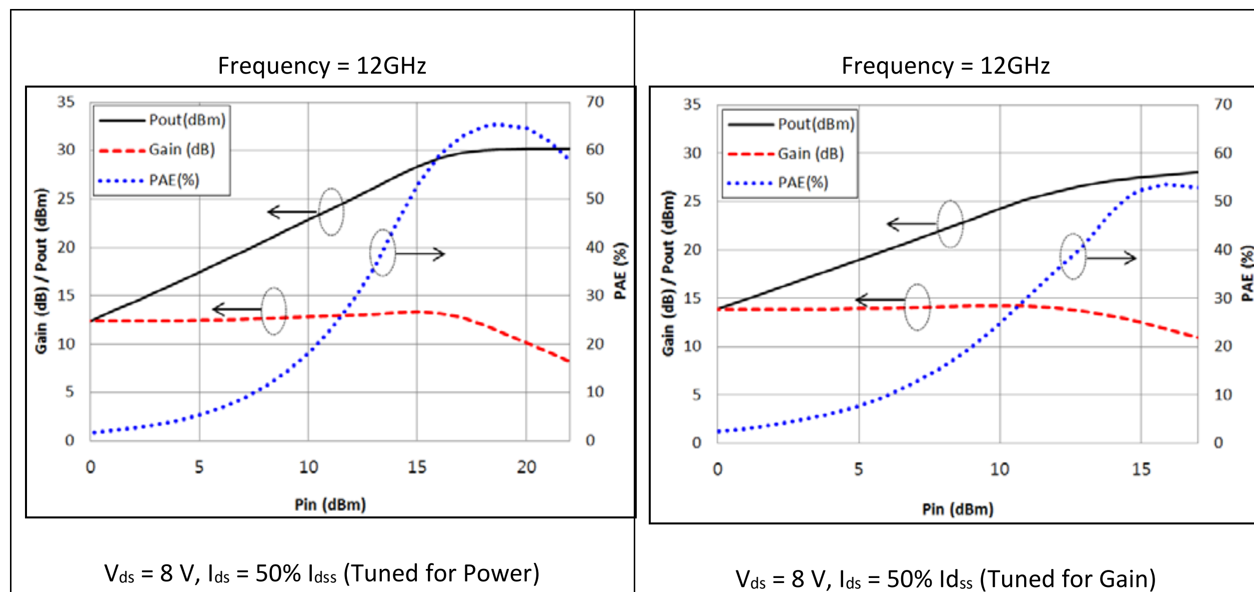
| SYMBOL | PARAMETER/TEST CONDITIONS | TEST FREQ. | MIN. | TYPICAL | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $P_{1dB}$ | Output Power @ $P_{1dB}$ ($V_{ds}$ = 8V, $I_{ds}$ = 50% $I_{dss}$) | 12 GHz<br>18 GHz | 26.0<br>27.5 | 27.5<br>29.0 | | dBm |
| $G_{1dB}$ | Gain @ $P_{1dB}$ ($V_{ds}$ = 8V, $I_{ds}$ = 50% $I_{dss}$) | 12 GHz<br>18 GHz | 12.0<br>9.0 | 13.0<br>10.0 | | dB |
| PAE | PAE @ $P_{1dB}$ ($V_{ds}$ = 8V, $I_{ds}$ = 50% $I_{dss}$) | 12 GHz<br>18 GHz | | 50<br>55 | | % |

## MAXIMUM RATING ($T_a$ = 25° C)

| SYMBOLS | PARAMETERS | ABSOLUTE | CONTINUOUS |
|---|---|---|---|
| $V_{ds}$ | Drain-Source Voltage | 12 V | 8 V |
| $V_{gs}$ | Gate-Source Voltage | -8 V | -3 V |
| $I_{ds}$ | Drain Current | $I_{dss}$ | $I_{dss}$ |
| $I_{gsf}$ | Forward Gate Current | 40 mA | 7 mA |
| $P_{in}$ | Input Power | 27 dBm | @ 3dB 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 | 2.5 W | 2.1 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)




$V_{ds}$ = 8 V, $I_{ds}$ = 50% $I_{dss}$ (Tuned for Power)

$V_{ds}$ = 8 V, $I_{ds}$ = 50% $Id_{ss}$ (Tuned for Gain)



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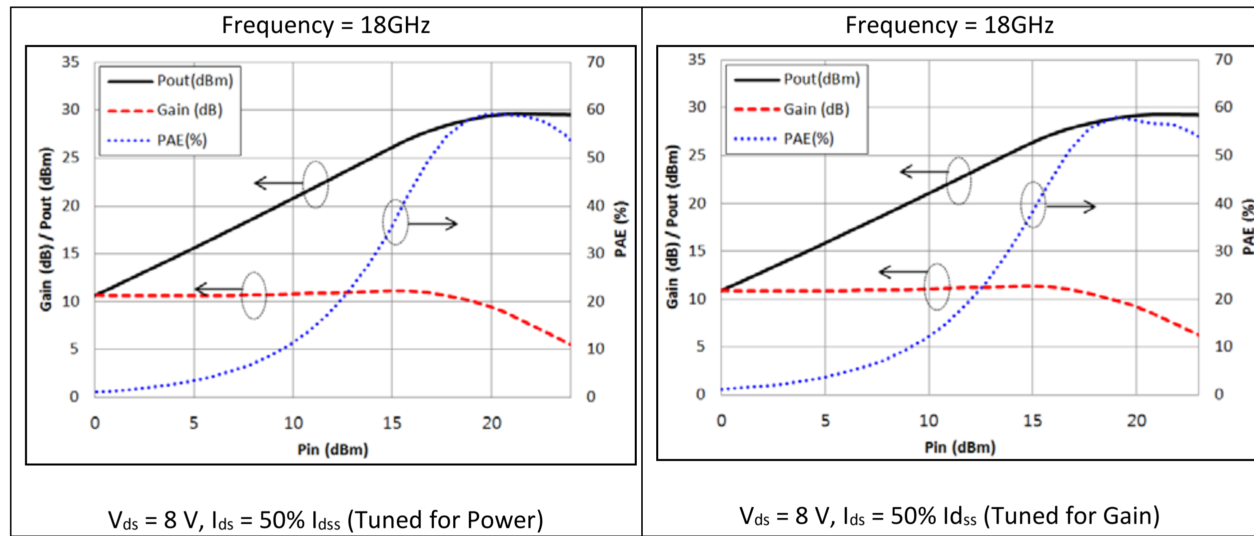
## $P_{IN}$_$P_{OUT}$/Gain, PAE (18 GHz)




$V_{ds}$ = 8 V, $I_{ds}$ = 50% $I_{dss}$ (Tuned for Power)

$V_{ds}$ = 8 V, $I_{ds}$ = 50% $Id_{ss}$ (Tuned for Gain)

## S-PARAMETER ($V_{ds}$ = 8V, $I_{ds}$ = 50% $I_{dss}$)

| FREQ. [GHZ] | S11 [MAG] | S11 [ANG.] | S21 [MAG] | S21 [ANG.] | S12 [MAG] | S12 [ANG.] | S22 [MAG] | S22 [ANG.] |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.90 | -80.81 | 14.18 | 132.87 | 0.034 | 48.617 | 0.35 | -53.62 |
| 2 | 0.86 | -122.78 | 9.47 | 109.07 | 0.045 | 31.997 | 0.27 | -81.38 |
| 3 | 0.84 | -145.71 | 6.86 | 94.32 | 0.048 | 24.841 | 0.24 | -97.12 |
| 4 | 0.84 | -161.07 | 5.31 | 83.42 | 0.049 | 20.743 | 0.22 | -106.56 |
| 5 | 0.84 | -171.88 | 4.31 | 74.30 | 0.049 | 19.202 | 0.22 | -115.48 |
| 6 | 0.84 | 179.59 | 3.61 | 66.44 | 0.049 | 18.561 | 0.22 | -120.27 |
| 7 | 0.84 | 172.04 | 3.09 | 59.24 | 0.049 | 17.423 | 0.23 | -125.61 |
| 8 | 0.85 | 165.30 | 2.69 | 52.08 | 0.049 | 18.330 | 0.24 | -131.87 |
| 9 | 0.85 | 159.07 | 2.37 | 45.42 | 0.049 | 18.362 | 0.26 | -136.95 |
| 10 | 0.86 | 152.97 | 2.10 | 38.83 | 0.048 | 18.850 | 0.27 | -143.16 |
| 11 | 0.87 | 147.86 | 1.87 | 32.61 | 0.047 | 19.849 | 0.30 | -148.66 |
| 12 | 0.88 | 144.05 | 1.67 | 27.23 | 0.047 | 20.641 | 0.32 | -152.94 |
| 13 | 0.89 | 140.19 | 1.51 | 21.68 | 0.047 | 19.988 | 0.34 | -158.21 |
| 14 | 0.90 | 136.46 | 1.37 | 16.47 | 0.048 | 20.783 | 0.38 | -163.20 |
| 15 | 0.91 | 133.41 | 1.25 | 11.89 | 0.049 | 21.641 | 0.40 | -165.72 |
| 16 | 0.92 | 129.89 | 1.14 | 6.67 | 0.049 | 20.932 | 0.43 | -169.28 |
| 17 | 0.93 | 125.68 | 1.06 | 1.22 | 0.052 | 20.105 | 0.47 | -172.45 |
| 18 | 0.93 | 123.10 | 0.97 | -3.65 | 0.052 | 19.082 | 0.50 | -174.65 |
| 19 | 0.94 | 119.63 | 0.89 | -8.89 | 0.054 | 17.318 | 0.51 | -177.15 |
| 20 | 0.94 | 117.10 | 0.81 | -14.03 | 0.056 | 16.112 | 0.54 | 179.71 |
| 21 | 0.94 | 115.14 | 0.75 | -17.90 | 0.058 | 17.116 | 0.56 | 176.92 |
| 22 | 0.93 | 113.43 | 0.68 | -21.85 | 0.060 | 16.972 | 0.58 | 173.39 |
| 23 | 0.94 | 111.85 | 0.63 | -25.51 | 0.062 | 15.759 | 0.61 | 170.90 |
| 24 | 0.93 | 110.84 | 0.58 | -29.25 | 0.062 | 13.961 | 0.62 | 167.56 |
| 25 | 0.93 | 110.43 | 0.52 | -32.33 | 0.062 | 16.654 | 0.63 | 163.31 |
| 26 | 0.94 | 109.70 | 0.48 | -34.96 | 0.063 | 20.335 | 0.65 | 160.51 |

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



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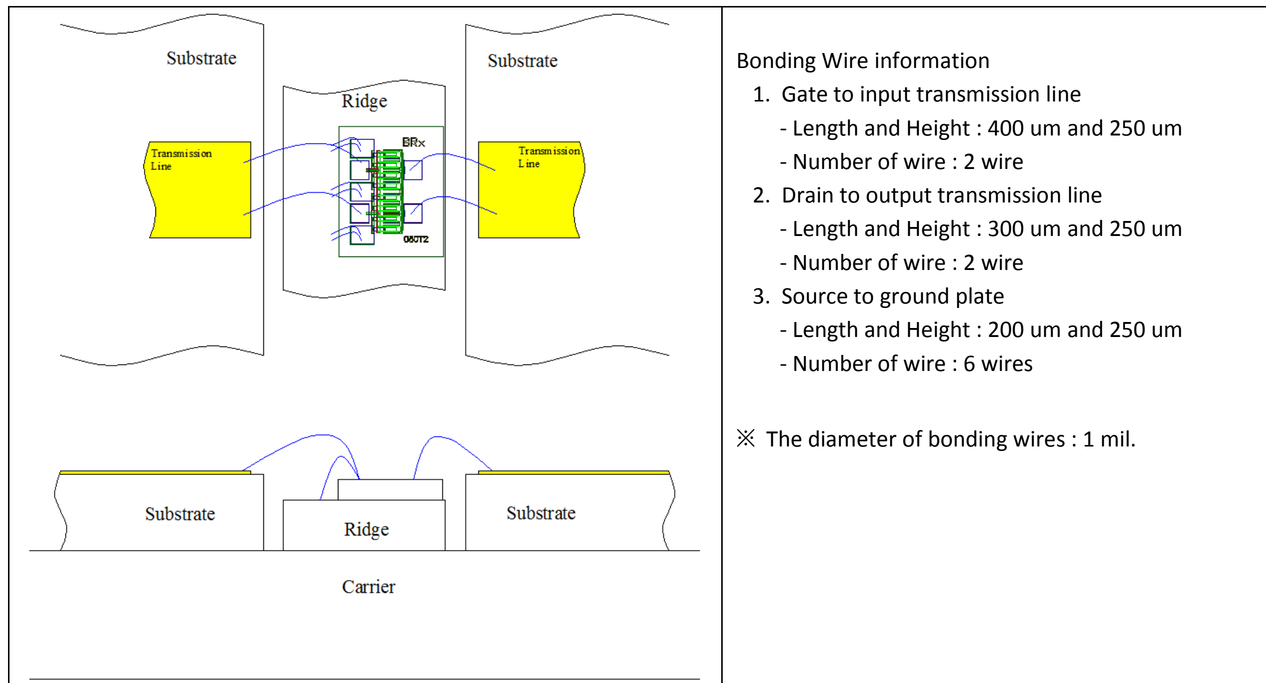
## WIRE BONDING INFORMATION

Follow the wire bonding diagrams recommended by BeRex below to achieve optimum device performance. BeRex recommends thermo-compression wedge bonding. 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. Ultrasonic bonding is not recommended.




Bonding Wire information

1. Gate to input transmission line
   - Length and Height : 400 um and 250 um
   - Number of wire : 2 wire
2. Drain to output transmission line
   - Length and Height : 300 um and 250 um
   - Number of wire : 2 wire
3. Source to ground plate
   - Length and Height : 200 um and 250 um
   - Number of wire : 6 wires

※ The diameter of bonding wires : 1 mil.

Proper ESD procedures should be followed when handling this device.

**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.

**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:**

BeRex's 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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**CAUTION:**

THIS PRODUCT CONTAINS GALLIUM ARSENIDE (GaAs) 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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For complete specifications, S-parameters and information on bonding and handling, visited our website;

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