

# BG14B

## 5-6000 MHz Cascadable InGaP HBT Gain Block



### Device Features

- OIP3 = 35 dBm @ 1900 MHz
- Gain = 16 dB @ 1900 MHz
- Output P1 dB = 19.5 dBm @ 1900 MHz
- 50  $\Omega$  Cascadable
- Patented temperature compensation
- Lead-free/RoHS-compliant SOT-89 SMT package



### Product Description

BeRex's BG14B is a high performance InGaP/ GaAs HBT MMIC amplifier, internally matched to 50 Ohms and uses a patented **temperature compensation** circuit to provide stable current over the operating temperature range without the need for external components. The BG14B is designed for high linearity gain block applications that require excellent gain flatness. It is packaged in a RoHS-compliant with SOT-89 surface mount package.

### Typical Performance<sup>1</sup>

| Parameter         | Frequency |       |       |       |       |       | Unit |
|-------------------|-----------|-------|-------|-------|-------|-------|------|
|                   | 70        | 500   | 900   | 1900  | 2450  | 5800  |      |
| Gain              | 17.3      | 17.3  | 17.0  | 16.0  | 15.2  | 11.9  | dB   |
| S11               | -20.0     | -18.5 | -17.5 | -27.5 | -19.0 | -9.3  | dB   |
| S22               | -13.0     | -14.0 | -15.0 | -10.5 | -10.0 | -12.6 | dB   |
| OIP3 <sup>2</sup> | 37.0      | 37.5  | 36.5  | 35.0  | 33.5  | 25.5  | dBm  |
| P1dB              | 19.5      | 19.5  | 19.5  | 19.5  | 19.5  | 15.5  | dBm  |
| NF                | 5.0       | 5.0   | 5.0   | 5.2   | 5.5   | 9.5   | dB   |

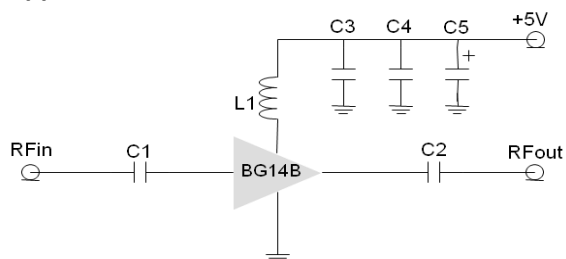
<sup>1</sup> Device performance \_ measured on a BeRex evaluation board at 25°C, 50  $\Omega$  system.

<sup>2</sup> OIP3 \_ measured with two tones at an output of 9 dBm per tone separated by 1 MHz.

### Applications

- Base station Infrastructure/RFID
- Commercial/Industrial/Military wireless system

### Applications Circuit



\*C1, C2, C3 = 100 pF  $\pm$  5%; C4 = 1000 pF  $\pm$  5%; C5 = 10uF; L1 = 39nH

\*less than 20nH improves RF performance at over 1.9GHz.

\*40nH or higher value L1 improves RF performance at under 500MHz.

\*Optimum value of L1 may vary with board design.

\*C1,C2=8200pF, L1=1200nH for 70MHz application,

Vcc=5.2V if 1200nH is used to compensate IR drop across L1.

|                                        | Min. | Typical | Max. | Unit  |
|----------------------------------------|------|---------|------|-------|
| Bandwidth                              | 5    |         | 6000 | MHz   |
| I <sub>C</sub> @ (V <sub>C</sub> = 5V) | 70   | 75      | 85   | mA    |
| V <sub>C</sub>                         |      | 5.0     |      | V     |
| dG/dT                                  |      | -0.004  |      | dB/°C |
| R <sub>TH</sub>                        |      | 85      |      | °C/W  |

### Absolute Maximum Ratings

| Parameter                  | Rating      | Unit |
|----------------------------|-------------|------|
| Operating Case Temperature | -40 to +85  | °C   |
| Storage Temperature        | -55 to +155 | °C   |
| Junction Temperature       | +220        | °C   |
| Operating Voltage          | +6.5        | V    |
| Supply Current             | 150         | mA   |
| Input RF Power             | 23          | dBm  |

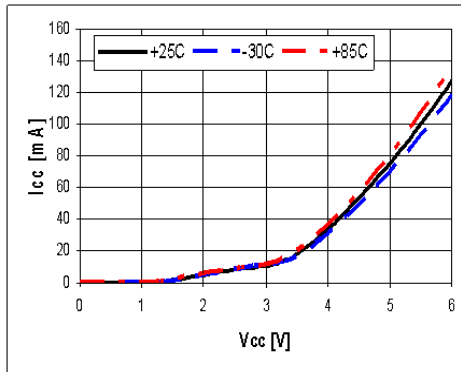
Operation of this device above any of these parameters may result in permanent damage.

# BG14B

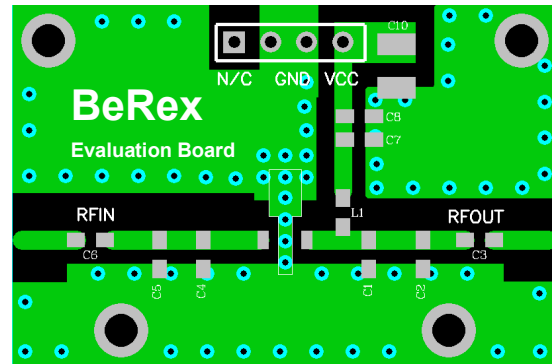
## 5-6000 MHz Cascadable InGaP HBT Gain Block



### V-I Characteristics



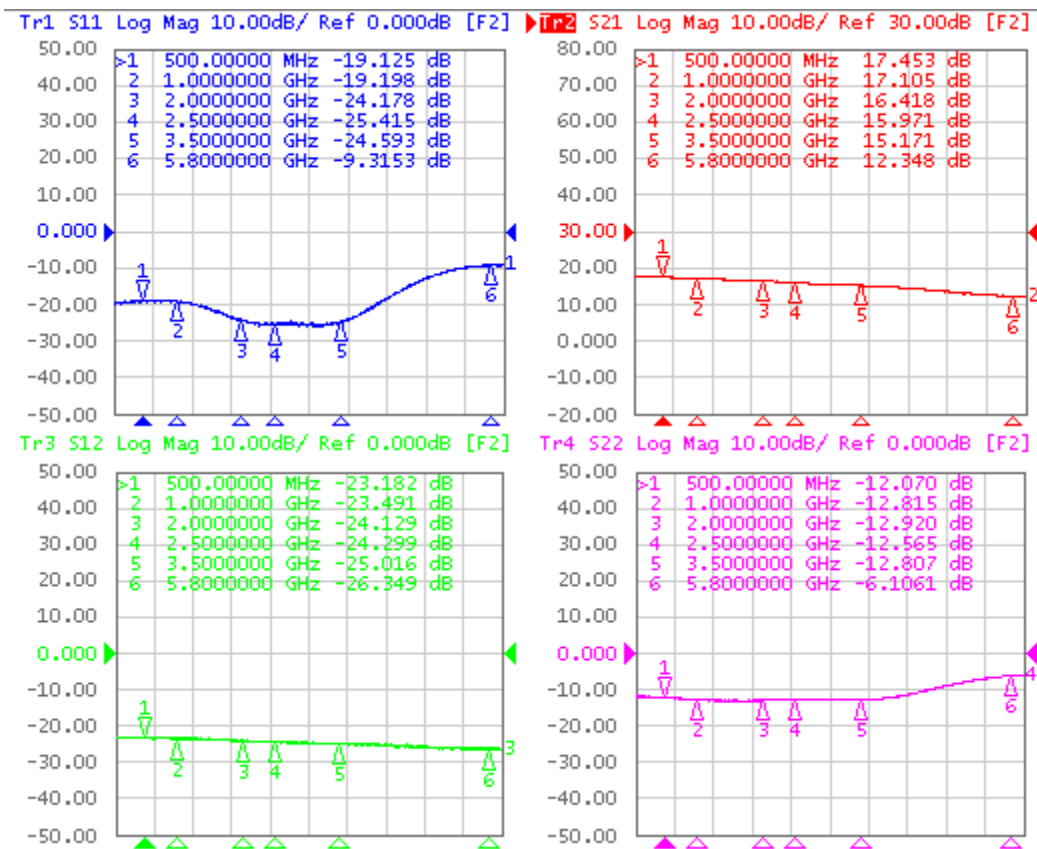
### BeRex SOT89 Evaluation Board



\*Dielectric constant \_ 4.2 \*RF pattern width 52mil \*31mil thick FR4 PCB

### Typical Device Data

S-parameters (Vc=5V, Ic=75mA, T=25°C)



### S-Parameter

(V<sub>device</sub> = 5.0V, I<sub>cc</sub> = 75mA, T = 25 °C, calibrated to device leads)

| Freq<br>[MHz] | S11<br>[Mag] | S11<br>[Ang] | S21<br>[Mag] | S21<br>[Ang] | S12<br>[Mag] | S12<br>[Ang] | S22<br>[Mag] | S22<br>[Ang] |
|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 100           | 0.10         | 172.59       | 7.52         | 176.08       | 0.07         | -1.13        | 0.25         | -2.29        |
| 500           | 0.11         | 144.81       | 7.44         | 160.32       | 0.07         | -4.61        | 0.25         | -14.25       |
| 1000          | 0.11         | 119.76       | 7.18         | 141.80       | 0.07         | -8.83        | 0.23         | -30.32       |
| 1500          | 0.09         | 98.38        | 6.87         | 123.97       | 0.07         | -14.36       | 0.22         | -48.36       |
| 2000          | 0.06         | 67.85        | 6.63         | 106.70       | 0.06         | -19.20       | 0.23         | -67.60       |
| 2500          | 0.05         | 34.29        | 6.29         | 89.21        | 0.06         | -22.00       | 0.23         | -86.64       |
| 3000          | 0.05         | 35.15        | 5.91         | 73.62        | 0.06         | -27.28       | 0.23         | -103.70      |
| 3500          | 0.06         | 75.25        | 5.73         | 57.81        | 0.06         | -30.16       | 0.23         | -122.21      |
| 4000          | 0.09         | 123.48       | 5.45         | 41.55        | 0.05         | -32.75       | 0.25         | -141.14      |
| 6000          | 0.34         | 159.36       | 4.04         | -15.47       | 0.05         | -44.60       | 0.51         | -166.34      |

Typical Performance (V<sub>d</sub> = 5V, I<sub>c</sub> = 75mA, T = 25°C)

| Freq | MHz | 70    | 500   | 900   | 1900  | 2140  | 2450  | 3500  | 5800  |
|------|-----|-------|-------|-------|-------|-------|-------|-------|-------|
| S21  | dB  | 17.3  | 17.3  | 17.0  | 16.0  | 15.7  | 15.2  | 14.8  | 11.9  |
| S11  | dB  | -20.0 | -18.5 | -17.5 | -27.5 | -23.0 | -19.0 | -16.0 | -9.3  |
| S22  | dB  | -13.0 | -14.0 | -15.0 | -10.5 | -11.5 | -10.0 | -13.0 | -12.6 |
| P1   | dBm | 19.5  | 19.5  | 19.5  | 19.5  | 19.5  | 19.5  | 19.5  | 25.5  |
| OIP3 | dBm | 37.0  | 37.5  | 36.5  | 35.0  | 34.5  | 33.5  | 32.5  | 15.7  |
| NF   | dB  | 5.0   | 5.0   | 5.0   | 5.2   | 5.3   | 5.5   | 5.8   | 9.5   |

Typical Performance (V<sub>d</sub> = 4.7V, I<sub>c</sub> = 67mA, T = 25°C)

| Freq | MHz | 70    | 500   | 900   | 1900  | 2140  | 2450  | 3500  |
|------|-----|-------|-------|-------|-------|-------|-------|-------|
| S21  | dB  | 16.8  | 17.1  | 16.9  | 15.9  | 15.7  | 15.1  | 13.7  |
| S11  | dB  | -10.3 | -24.8 | -24.4 | -25.4 | -24.0 | -25.4 | -23.2 |
| S22  | dB  | -10.6 | -11.0 | -10.6 | -9.7  | -9.2  | -9.8  | -12.6 |
| P1   | dBm | 17.9  | 17.9  | 18.0  | 18.2  | 17.6  | 17.8  | 17.1  |
| OIP3 | dBm | 35.5  | 33.5  | 33.5  | 33.0  | 32.5  | 32    | 30.0  |
| NF   | dB  | 5.0   | 5.0   | 5.0   | 5.2   | 5.3   | 5.5   | 5.8   |

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## 5-6000 MHz Cascadable InGaP HBT Gain Block

Typical Performance (Vd = 4.5V, Ic = 58mA, T = 25°C)

| Freq | MHz | 70    | 500   | 900   | 1900  | 2140  | 2450  | 3500  |
|------|-----|-------|-------|-------|-------|-------|-------|-------|
| S21  | dB  | 16.6  | 17.0  | 16.8  | 15.8  | 15.8  | 15.1  | 13.6  |
| S11  | dB  | -11.0 | -26.1 | -25.4 | -25.3 | -23.6 | -25.1 | -22.6 |
| S22  | dB  | -9.2  | -10.3 | -10.4 | -9.5  | -9.1  | -9.7  | -12.4 |
| P1   | dBm | 17.2  | 17.2  | 16.6  | 16.7  | 16.7  | 16.8  | 16.2  |
| OIP3 | dBm | 33.0  | 33.0  | 32.0  | 31.5  | 31.5  | 30.5  | 29.0  |
| NF   | dB  | 5.0   | 5.0   | 5.0   | 5.2   | 5.3   | 5.5   | 5.8   |

Typical Performance (Vd = 4V, Ic = 37mA, T = 25°C)

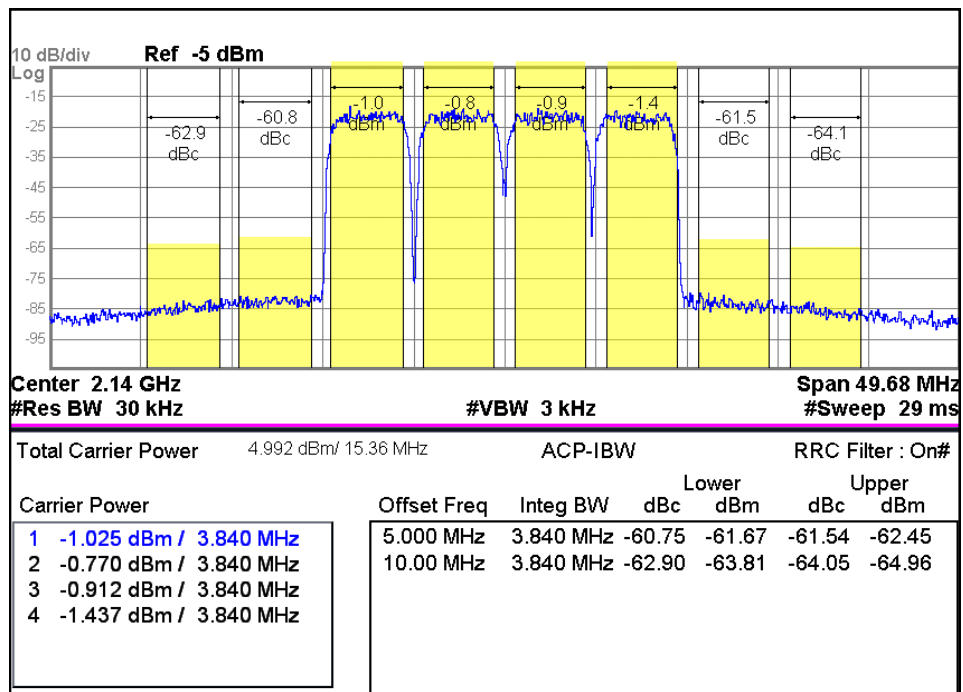
| Freq | MHz | 70    | 500   | 900   | 1900  | 2140  | 2450  | 3500  |
|------|-----|-------|-------|-------|-------|-------|-------|-------|
| S21  | dB  | 15.9  | 15.9  | 16.0  | 15.1  | 14.8  | 14.4  | 13.3  |
| S11  | dB  | -11.7 | -31.4 | -29.5 | -23.4 | -21.8 | -23.1 | -20.1 |
| S22  | dB  | -8.6  | -9.5  | -9.6  | -8.8  | -8.5  | -9.1  | -11.8 |
| P1   | dBm | 12.2  | 12.6  | 12.6  | 12.9  | 12.3  | 11.8  | 12.5  |
| OIP3 | dBm | 25.5  | 24.0  | 24.5  | 25.0  | 24.5  | 25.0  | 24    |
| NF   | dB  | 5.0   | 5.0   | 5.0   | 5.2   | 5.3   | 5.5   | 5.8   |

# BG14B

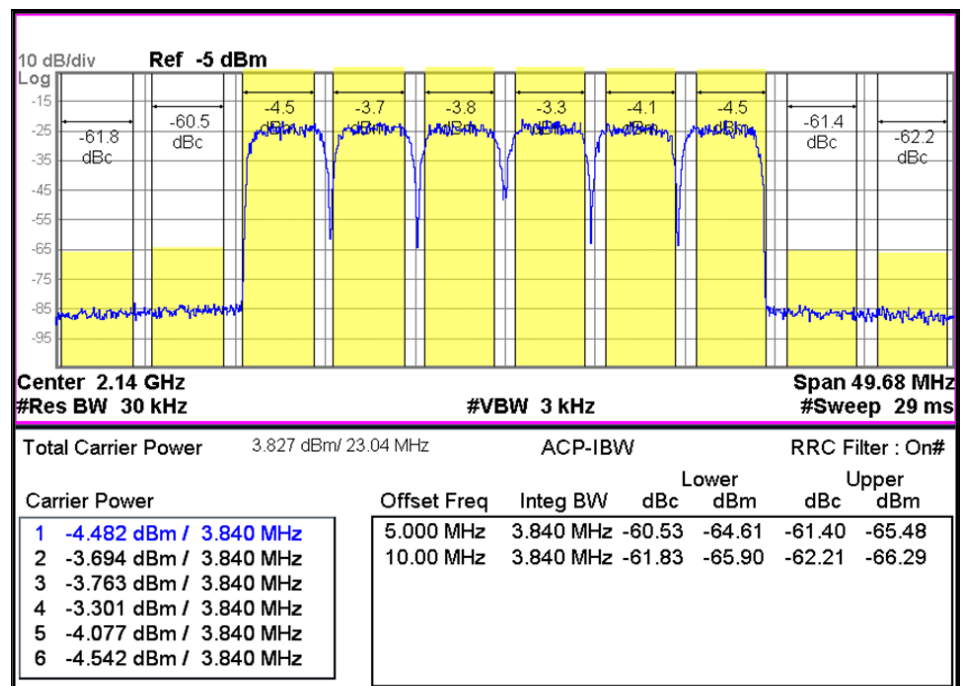
5-6000 MHz Cascadable InGaP HBT Gain Block



## WCDMA 4FA 2140 -60dBc



## WCDMA 6FA 2140 -60dBc

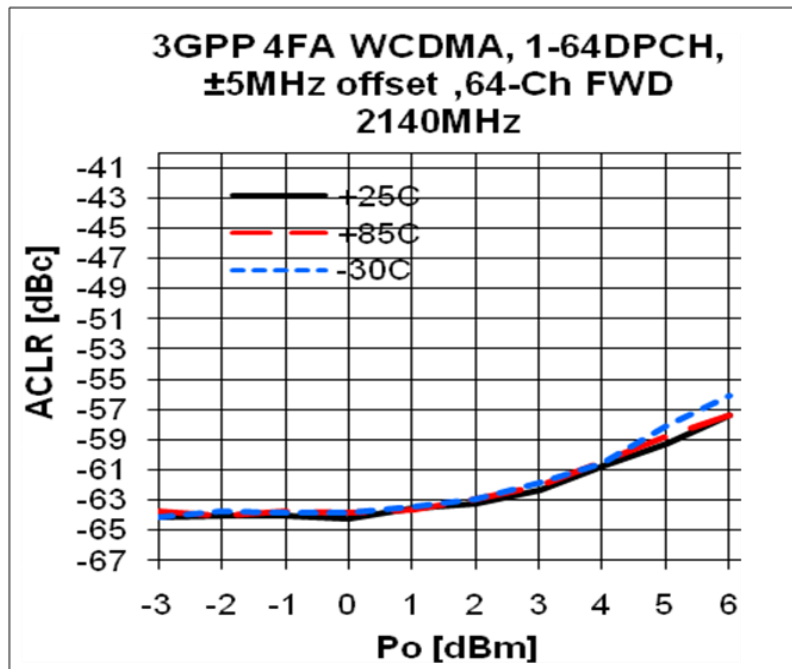


# BG14B

5-6000 MHz Cascadable InGaP HBT Gain Block

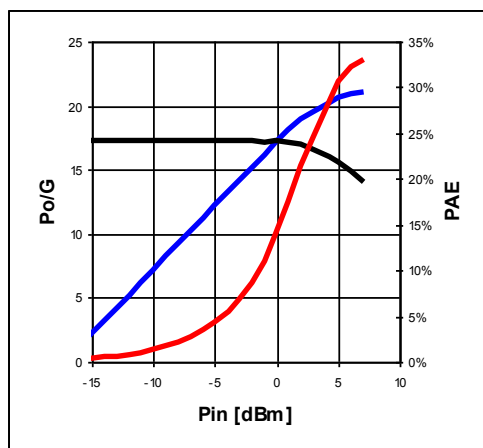


## ACLR

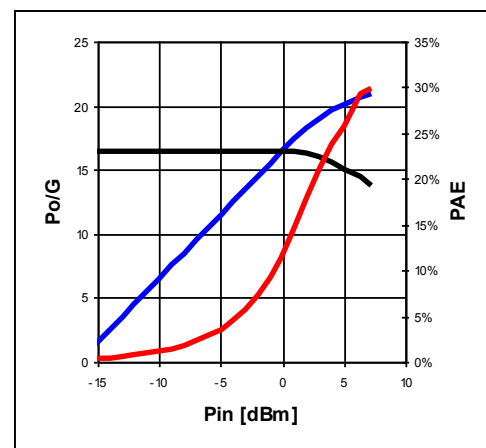


## Device Performance

### Pin-Pout-Gain



900MHz, 5V/75mA



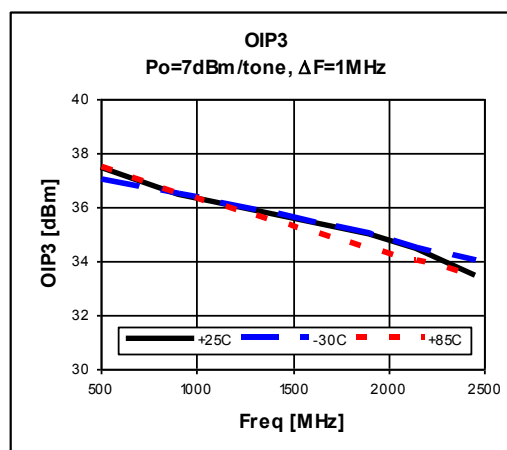
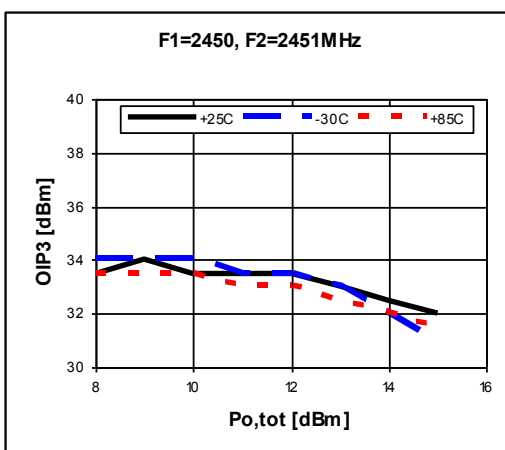
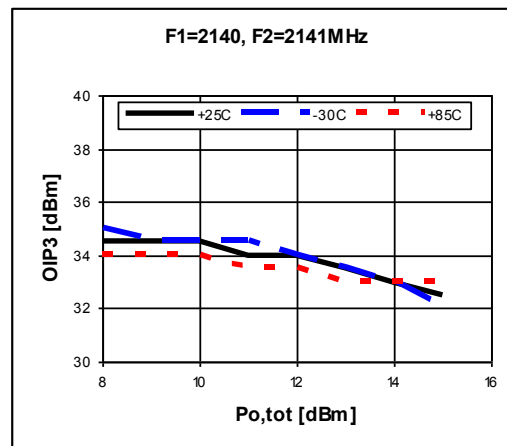
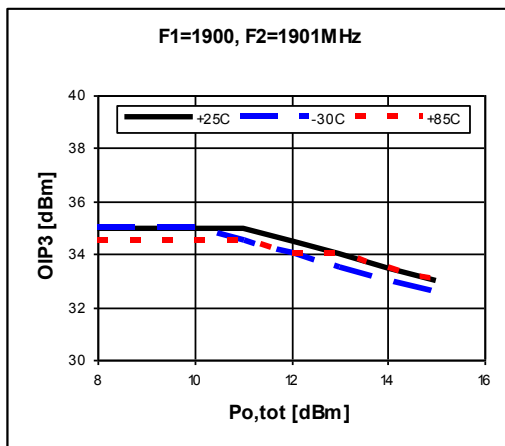
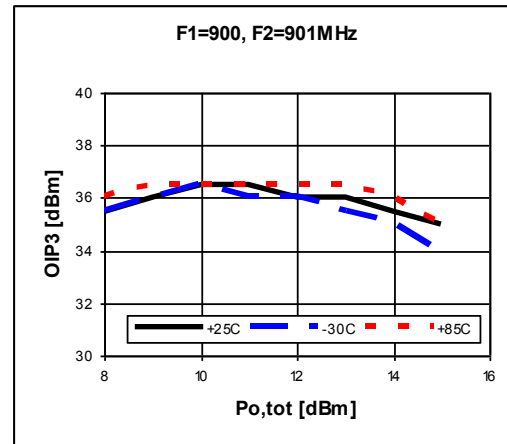
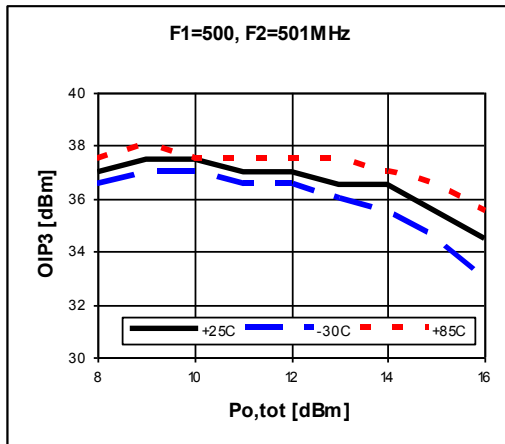
1900 MHz, 5V/75mA

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## OIP3

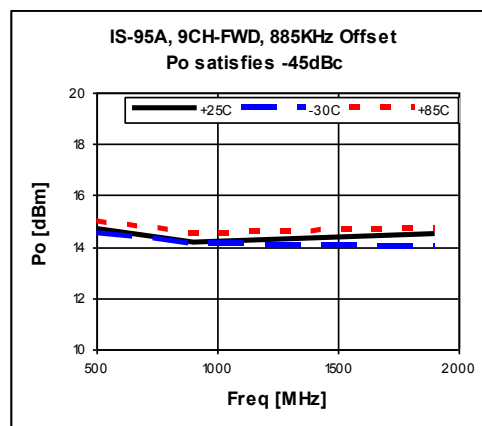
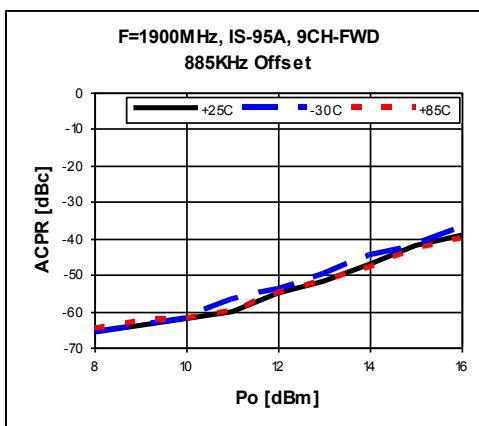
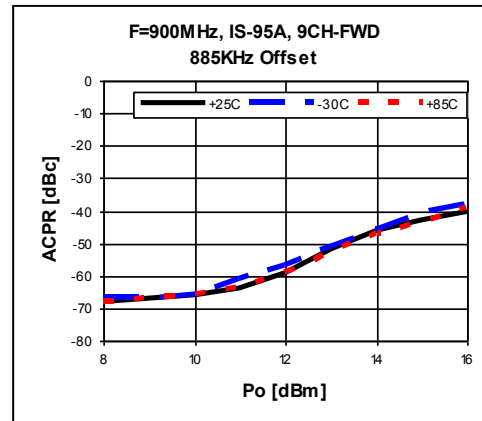
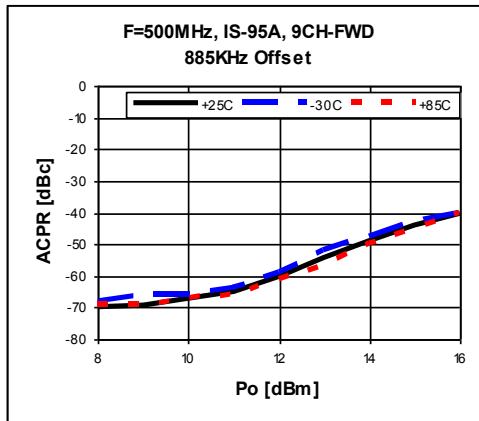


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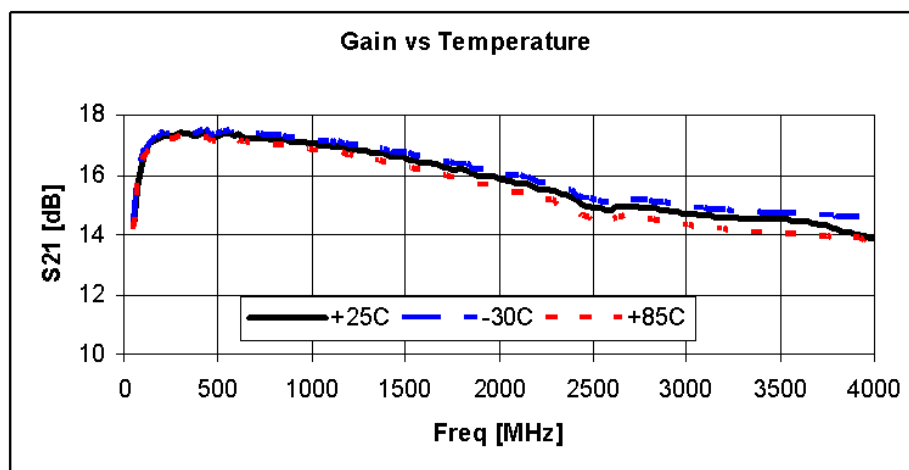
5-6000 MHz Cascadable InGaP HBT Gain Block



## ACPR



## Gain Flatness



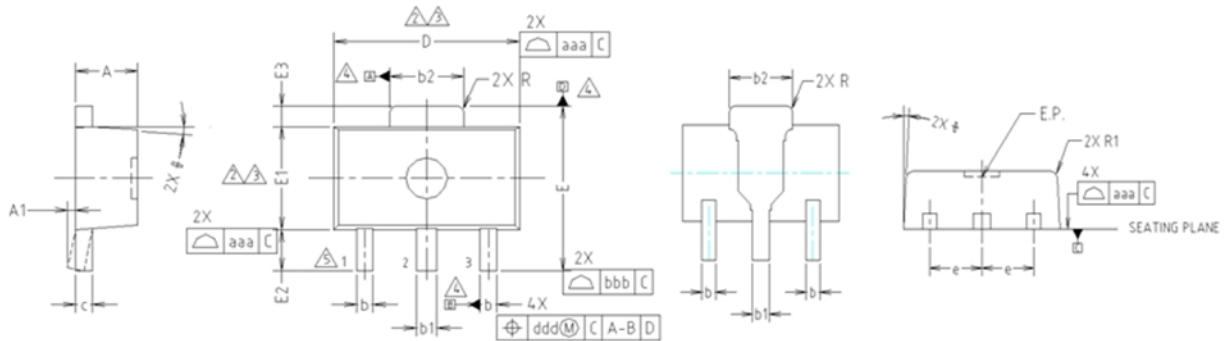


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## Package Outline Dimension



### NOTE:

1. DIMENSIONS IN MILLIMETERS.

⚠ DIMENSION D DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.5mm PER END. DIMENSION E1 DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.5mm PER SIDE.

⚠ DIMENSIONS D AND E1 ARE DETERMINED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.

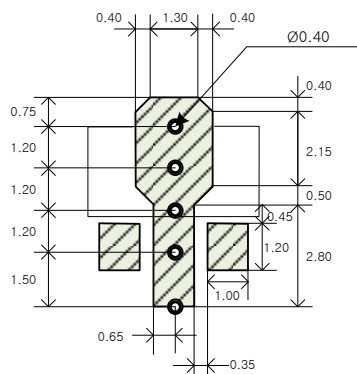
⚠ DATUMS A, B AND D TO BE DETERMINED 0.18mm FROM THE LEAD TIP.

⚠ TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.

| SYMBOL | MILLIMETERS                     |         |         | NOTE |
|--------|---------------------------------|---------|---------|------|
|        | MINIMUM                         | NOMINAL | MAXIMUM |      |
| A      | 1.40                            | 1.50    | 1.60    |      |
| A1     | 0.00                            | —       | 0.10    |      |
| b      | 0.38                            | 0.42    | 0.48    |      |
| b1     | 0.48                            | 0.52    | 0.58    |      |
| b2     | 1.79                            | 1.82    | 1.87    |      |
| c      | 0.40                            | 0.42    | 0.46    |      |
| D      | 4.40                            | 4.50    | 4.70    | 2,3  |
| E      | 3.70                            | 4.00    | 4.30    |      |
| E1     | 2.40                            | 2.50    | 2.70    | 2,3  |
| E2     | 0.80                            | 1.00    | 1.20    |      |
| E3     | 0.40                            | 0.50    | 0.60    |      |
| e      | 1.50 TYP.                       |         |         |      |
| φ      | 4° TYP.                         |         |         |      |
| R      | 0.15 TYP.                       |         |         |      |
| R1     | —                               | —       | 0.20    |      |
| SYMBOL | TOLERANCES OF FORM AND POSITION |         | NOTE    |      |
|        |                                 |         |         |      |
| aaa    | 0.15                            |         |         |      |
| bbb    | 0.20                            |         |         |      |
| ccc    | 0.10                            |         |         |      |
| ddd    | 0.10                            |         |         |      |

## Suggested PCB Land Pattern and PAD Layout

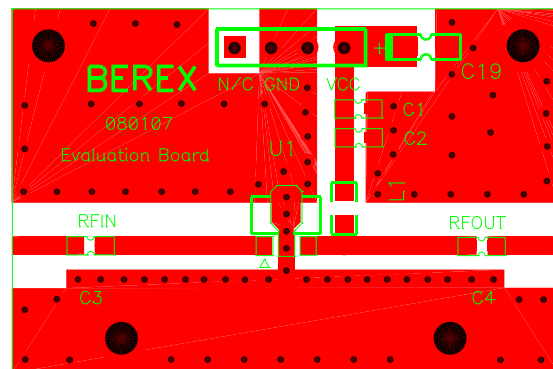
### PCB Land Pattern



Note : All dimension \_ millimeters

PCB lay out \_ on BeRex website

### PCB Mounting

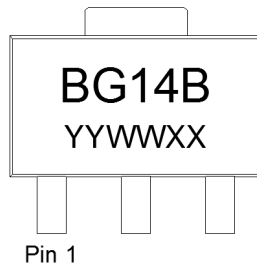


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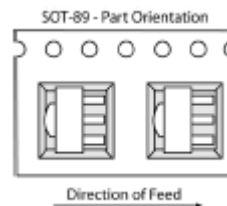
## Package Marking



YY = Year, WW = Working Week,  
XX = Wafer No.

## Tape & Reel

SOT89



Packaging information:

Tape Width (mm): 12  
Reel Size (inches): 7  
Device Cavity Pitch (mm): 8  
Devices Per Reel: 1000

## Lead plating finish

100% Tin Matte finish

(All BeRex products undergoes a 1 hour, 150 degree C, Anneal bake to eliminate thin whisker growth concerns.)

## MSL / ESD Rating

|                    |                                     |
|--------------------|-------------------------------------|
| <b>ESD Rating:</b> | Class 1C                            |
| <b>Value:</b>      | Passes <2000V                       |
| <b>Test:</b>       | Human Body Model (HBM)              |
| <b>Standard:</b>   | JEDEC Standard JESD22-A114B         |
| <b>MSL Rating:</b> | Level 1 at +265°C convection reflow |
| <b>Standard:</b>   | JEDEC Standard J-STD-020            |

## NATO CAGE code:

|   |   |   |   |   |
|---|---|---|---|---|
| 2 | N | 9 | 6 | F |
|---|---|---|---|---|