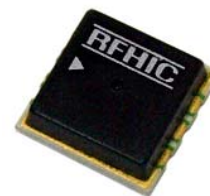


## Product Features

- GaAs p-HEMT chip on board
- No matching circuit needed
- High Maximum input power(+25dBm)
- High IP3 & Low Noise
- Single Supply Voltage (+5V)
- Surface Mount Hybrid Type
- Tape & Reel Packaging
- Small Size, High Heatsink
- Alumina Substrate
- Pb Free / RoHS Standard

## Applications

- 2G & 3G Repeater
- Base Station
- PCS, CDMA, W-CDMA
- GSM, DCS, UMTS
- WiMAX, Wibro, WLAN
- RF Sub-Systems



Package Type : CP-16A

## Description

RFHIC's LOW Noise Amplifier series are all hybrid LNA type products which includes all matching for the convenience of customers. CL series are focused on giving lowest noise possible. The structure of the device is built with GaAs p-HEMT die attached on a ceramic thick film substrate. The device is still smaller than the area one would use for the application notes all together. Depending on the part number, one can use this in different frequency applications. All LNA hybrids are possible to have custom frequency & spec without any additional NRE cost involved. All RFHIC products are RoHS compliant.

## Electrical Specifications

| PARAMETER  | UNIT | CL0902-L                |                    | CL1502-L    | CL1802-L    | CL2102-L    |
|--|------|-------------------------|--------------------|-------------|-------------|-------------|
| Frequency Range  | MHz  | 824 ~ 894<br>(Cellular) | 890 ~ 960<br>(GSM) | 1400 ~ 1600 | 1700 ~ 2000 | 1850 ~ 2200 |
| Small Signal Gain (S <sub>21</sub> )                       | dB   | 21                      | 20                 | 17          | 16          | 15          |
| Gain Flatness  | dB   | ±0.5                    | ±0.5               | ±0.5        | ±0.5        | ±1.0        |
| Input Return Loss (S <sub>11</sub> )                       | dB   | -17                     | -17                | -17         | -18         | -18         |
| Output Return Loss (S <sub>22</sub> )                      | dB   | -8.5                    | -8.5               | -10         | -10         | -10         |
| 1dB Compression Point (P <sub>1dB</sub> )                  | dBm  | 20                      | 20                 | 21          | 21          | 20          |
| Output 3 <sup>rd</sup> Order Intercept Point (OIP3) (TYP.) | dBm  | 31                      | 31                 | 33          | 33          | 33          |
| Noise Figure (TYP.)  | dB   | 0.7                     | 0.7                | 0.6         | 0.6         | 0.6         |
| DC Supply Current (V <sub>dc</sub> =+5V)                   | mA   | 100                     | 100                | 90          | 100         | 100         |

### Test Condition

- ① Supply voltage = +5V, 50ohm System, Ta = 25 °C
- ② OIP3 is measured with two tones, at an output power of +0dBm/tone separated by 1MHz.

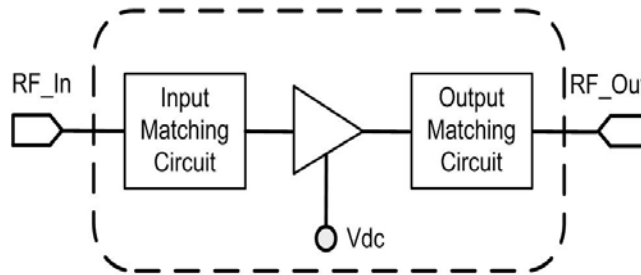
**Absolute Maximum Ratings**

| PARAMETER             | UNIT | RATING    | REMARK |
|-----------------------|------|-----------|--------|
| Device Voltage        | V    | 8         | -      |
| RF Input Power        | dBm  | 25        | -      |
| Operating Temperature | °C   | -40 ~ 85  | -      |
| Storage Temperature   | °C   | -50 ~ 125 | -      |

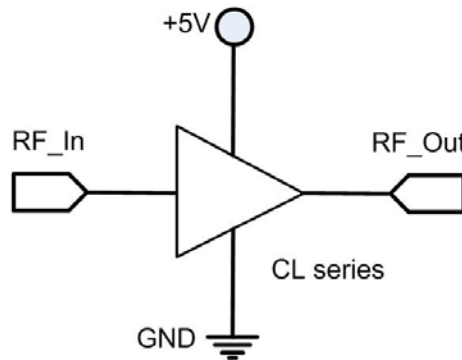
**Note**

Operation of this device in excess of any one of these parameters may cause permanent damage.

**Functional Diagram**



**Application Circuit**



**ESD Protection**

Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices. Some of the precautions recommended are;

- Person at a workbench should be earthed via a wrist strap and a resistor.
- All mains-powered equipment should be connected to the mains via an earth-leakage switch.
- Equipment cases should be grounded.
- Relative humidity should be maintained between 40% and 50%.
- An ionizer is recommended.
- Keep static materials, such as plastic envelopes and plastic trays etc. away from the workbench.

Noise Figure

CL0902-L(Cellular)

Agilent 11:01:57 May 17, 2007

| DUT Amplifier Sys Downconv Off |             |         | Frequency                  |
|--------------------------------|-------------|---------|----------------------------|
| Freq                           | NoiseFig dB | Gain dB | Freq Mode, Sweep           |
| 824.00000 MHz                  | 0.711       | 20.577  | Start Freq 824.000000 MHz  |
| 829.00000 MHz                  | 0.712       | 20.577  |                            |
| 834.00000 MHz                  | 0.696       | 20.510  | Stop Freq 894.000000 MHz   |
| 839.00000 MHz                  | 0.696       | 20.407  |                            |
| 844.00000 MHz                  | 0.613       | 20.300  | Center Freq 859.000000 MHz |
| 849.00000 MHz                  | 0.705       | 20.089  |                            |
| 854.00000 MHz                  | 0.646       | 19.938  | Freq Span 70.0000000 MHz   |
| 859.00000 MHz                  | 0.583       | 19.795  |                            |
| 864.00000 MHz                  | 0.621       | 19.645  | Fixed Freq 1.50500000 GHz  |
| 869.00000 MHz                  | 0.745       | 19.495  |                            |
| 874.00000 MHz                  | 0.711       | 19.470  |                            |
| 879.00000 MHz                  | 0.635       | 19.503  |                            |
| 884.00000 MHz                  | 0.658       | 19.510  |                            |
| 889.00000 MHz                  | 0.658       | 19.512  |                            |
| 894.00000 MHz                  | 0.612       | 19.515  |                            |

Start 824.00 MHz BW 4 MHz Points 15 Stop 894.00 MHz  
Tcold 382.90 K Avgs Off Att 0 dB Loss Off Corr

More 1 of 2

CL0902-L(GSM)

Agilent 11:01:14 May 17, 2007

| DUT Amplifier Sys Downconv Off |             |         | Frequency                  |
|--------------------------------|-------------|---------|----------------------------|
| Freq                           | NoiseFig dB | Gain dB | Freq Mode, Sweep           |
| 890.00000 MHz                  | 0.642       | 19.532  | Start Freq 890.000000 MHz  |
| 895.00000 MHz                  | 0.633       | 19.566  |                            |
| 900.00000 MHz                  | 0.671       | 19.559  | Stop Freq 960.000000 MHz   |
| 905.00000 MHz                  | 0.658       | 19.499  |                            |
| 910.00000 MHz                  | 0.584       | 19.460  | Center Freq 925.000000 MHz |
| 915.00000 MHz                  | 0.642       | 19.342  |                            |
| 920.00000 MHz                  | 0.673       | 19.221  | Freq Span 70.0000000 MHz   |
| 925.00000 MHz                  | 0.569       | 19.149  |                            |
| 930.00000 MHz                  | 0.582       | 19.055  | Fixed Freq 1.50500000 GHz  |
| 935.00000 MHz                  | 0.618       | 18.898  |                            |
| 940.00000 MHz                  | 0.600       | 18.817  |                            |
| 945.00000 MHz                  | 0.593       | 18.816  |                            |
| 950.00000 MHz                  | 0.616       | 18.800  |                            |
| 955.00000 MHz                  | 0.538       | 18.862  |                            |
| 960.00000 MHz                  | 0.599       | 18.874  |                            |

Start 890.00 MHz BW 4 MHz Points 15 Stop 960.00 MHz  
Tcold 382.73 K Avgs Off Att 0 dB Loss Off Corr

More 1 of 2

CL1502-L

Agilent 09:19:19 May 22, 2007

| DUT Amplifier Sys Downconv Off |             |         | Frequency                  |
|--------------------------------|-------------|---------|----------------------------|
| Freq                           | NoiseFig dB | Gain dB | Freq Mode, Sweep           |
| 1.400000 GHz                   | 0.586       | 17.762  | Start Freq 1.40000000 GHz  |
| 1.414286 GHz                   | 0.586       | 18.017  |                            |
| 1.428571 GHz                   | 0.578       | 17.422  | Stop Freq 1.60000000 GHz   |
| 1.442857 GHz                   | 0.657       | 16.726  |                            |
| 1.457143 GHz                   | 0.604       | 16.960  | Center Freq 1.50000000 GHz |
| 1.471429 GHz                   | 0.539       | 17.627  |                            |
| 1.485714 GHz                   | 0.570       | 17.234  | Freq Span 200.000000 MHz   |
| 1.500000 GHz                   | 0.577       | 16.576  |                            |
| 1.514286 GHz                   | 0.513       | 16.550  | Fixed Freq 1.50500000 GHz  |
| 1.528571 GHz                   | 0.587       | 16.938  |                            |
| 1.542857 GHz                   | 0.534       | 16.704  |                            |
| 1.557143 GHz                   | 0.551       | 16.265  |                            |
| 1.571429 GHz                   | 0.505       | 16.391  |                            |
| 1.585714 GHz                   | 0.496       | 16.787  |                            |
| 1.600000 GHz                   | 0.504       | 16.488  |                            |

Start 1.40000 GHz BW 4 MHz Points 15 Stop 1.60000 GHz  
Tcold 382.90 K Avgs Off Att 0 dB Loss Off Corr

More 1 of 2

CL1802-L

Agilent 09:24:27 May 22, 2007

| DUT Amplifier Sys Downconv Off |             |         | Frequency                  |
|--------------------------------|-------------|---------|----------------------------|
| Freq                           | NoiseFig dB | Gain dB | Freq Mode, Sweep           |
| 1.750000 GHz                   | 0.578       | 15.278  | Start Freq 1.75000000 GHz  |
| 1.758571 GHz                   | 0.643       | 15.438  |                            |
| 1.767143 GHz                   | 0.621       | 15.563  | Stop Freq 1.87000000 GHz   |
| 1.775714 GHz                   | 0.575       | 15.485  |                            |
| 1.784286 GHz                   | 0.610       | 15.206  | Center Freq 1.81000000 GHz |
| 1.792857 GHz                   | 0.626       | 15.053  |                            |
| 1.801429 GHz                   | 0.606       | 15.026  | Freq Span 120.000000 MHz   |
| 1.810000 GHz                   | 0.554       | 15.128  |                            |
| 1.818571 GHz                   | 0.600       | 15.147  | Fixed Freq 1.50500000 GHz  |
| 1.827143 GHz                   | 0.609       | 15.090  |                            |
| 1.835714 GHz                   | 0.582       | 14.800  |                            |
| 1.844286 GHz                   | 0.616       | 14.607  |                            |
| 1.852857 GHz                   | 0.613       | 14.488  |                            |
| 1.861429 GHz                   | 0.602       | 14.569  |                            |
| 1.870000 GHz                   | 0.599       | 14.816  |                            |

Start 1.75000 GHz BW 4 MHz Points 15 Stop 1.87000 GHz  
Tcold 383.15 K Avgs Off Att 0 dB Loss Off Corr

More 1 of 2

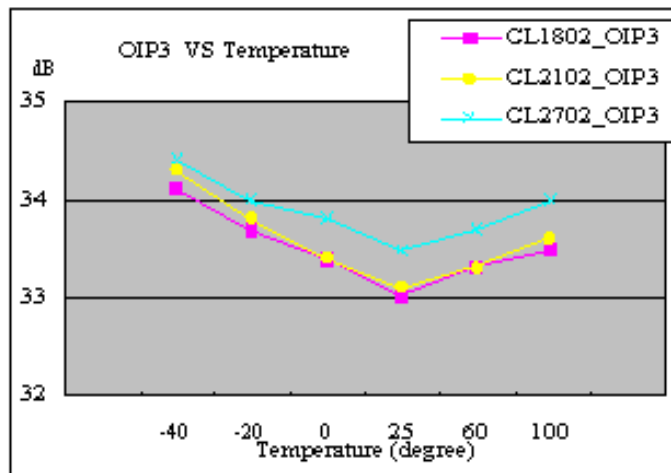
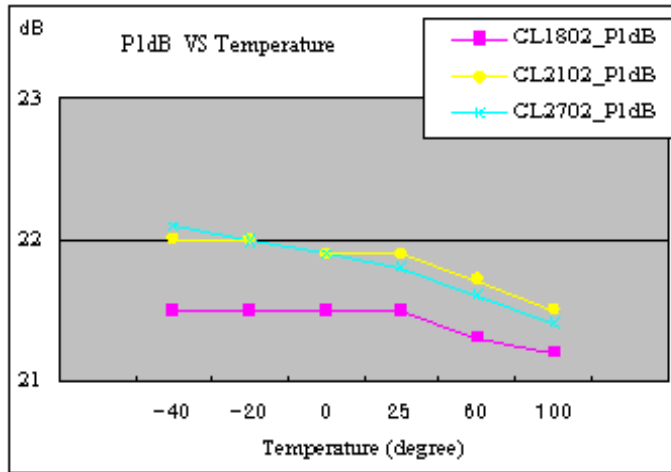
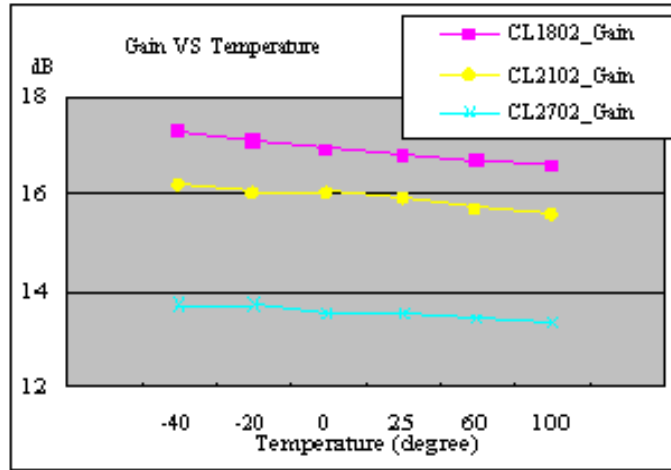
CL2102-L

Agilent 09:31:14 May 22, 2007

| DUT Amplifier Sys Downconv Off |             |         | Frequency                  |
|--------------------------------|-------------|---------|----------------------------|
| Freq                           | NoiseFig dB | Gain dB | Freq Mode, Sweep           |
| 1.920000 GHz                   | 0.508       | 14.575  | Start Freq 1.92000000 GHz  |
| 1.937857 GHz                   | 0.557       | 14.656  |                            |
| 1.955714 GHz                   | 0.589       | 14.467  | Stop Freq 2.17000000 GHz   |
| 1.973571 GHz                   | 0.500       | 14.457  |                            |
| 1.991429 GHz                   | 0.572       | 14.424  | Center Freq 2.04500000 GHz |
| 2.009286 GHz                   | 0.602       | 14.225  |                            |
| 2.027143 GHz                   | 0.624       | 13.973  | Freq Span 250.000000 MHz   |
| 2.045000 GHz                   | 0.536       | 14.151  |                            |
| 2.062857 GHz                   | 0.577       | 13.949  | Fixed Freq 1.50500000 GHz  |
| 2.080714 GHz                   | 0.578       | 13.706  |                            |
| 2.098571 GHz                   | 0.653       | 13.715  |                            |
| 2.116429 GHz                   | 0.646       | 13.812  |                            |
| 2.134286 GHz                   | 0.531       | 13.565  |                            |
| 2.152143 GHz                   | 0.617       | 13.396  |                            |
| 2.170000 GHz                   | 0.590       | 13.595  |                            |

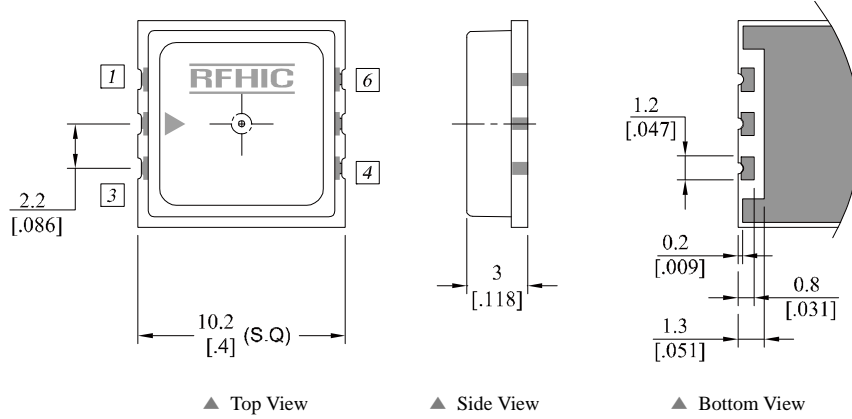
Start 1.92000 GHz BW 4 MHz Points 15 Stop 2.17000 GHz  
Tcold 383.52 K Avgs Off Att 0 dB Loss Off Corr

More 1 of 2



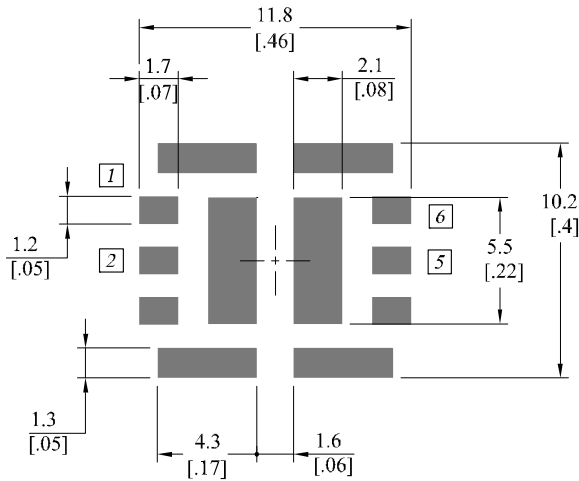
Package Dimensions (Type: CP-16A)

\* Unit: mm[inch] | Tolerance ±0.15[.006]

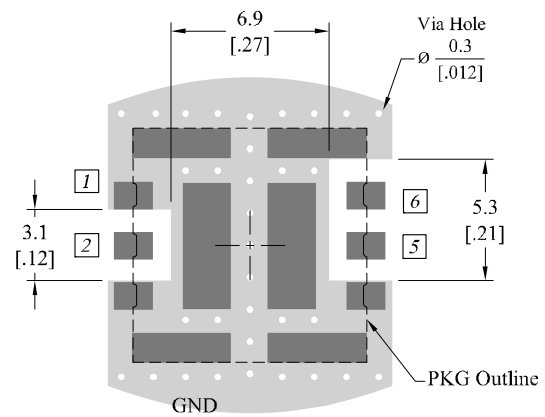


| Pin Description |          |        |          |
|-----------------|----------|--------|----------|
| Pin No          | Function | Pin No | Function |
| 1               | GND      | 4      | GND      |
| 2               | Input    | 5      | Output   |
| 3               | GND      | 6      | Vcc      |

Recommended Pattern



Recommended Mounting Configuration



\* Mounting Configuration Notes

1. Ground / thermal via holes are critical for the proper performance of this device.
2. Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
3. Mounting screws can be added near the part to fasten the board to a heatsink. Ensure that the ground / thermal via hole region contacts the heatsink.
4. Do not put solder mask on the backside of the PCB in the region where the board contacts the heatsink.
5. RF trace width depends upon the PCB material and construction.
6. Use 1 oz. Copper minimum.

**Revision History**

| Part Number                                  | Release Date | Version | Modification         | Data Sheet Status |
|--|--------------|---------|----------------------|-------------------|
| CL0902-L<br>CL1502-L<br>CL1802-L<br>CL2102-L | 2012.10.19   | 6.3     | New datasheet format | -                 |
| CL0902-L<br>CL1502-L<br>CL1802-L<br>CL2102-L | 2012.2.18    | 6.2     | -                    | -                 |
|  |              |         |                      |                   |

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