# Low Noise Amplifier

# CL0901-L / CL1501-L CL1801-L / CL2101-L

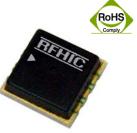
# **RFHIC**

### **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 : CP-16A

# Descriptions

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	Units	CL0901-L		CL1501-L	CL1801-L	CL2101-L
Frequency Range	MHz	824~894 (Cellular)	890~960 (GSM)	1400~1600	1700~2000	1850~2200
Small Signal Gain (S <sub>21</sub> )	dB	19	18	16	15.5	14
Gain Flatness	dB	±0.5	±0.5	±0.5	±0.5	±1.0
Input Return Loss (S <sub>11</sub> )	dB	-18	-18	-18	-18	-18
Output Return Loss (S <sub>22</sub> )	dB	-10	-10	-10	-10	-10
1dB Compression Point (P <sub>1</sub> dB)	dBm	14	14	15	16	16
Output 3 <sup>rd</sup> Order Intercept Point (OIP3) (TYP.)	dBm	27	27	27	27	27
Noise Figure (TYP.)	dB	0.5	0.5	0.7	0.6	0.7
DC Supply Current (Vdc=+5V)	mA	65	65	45	45	45

#### **Test Condition**

① Supply voltage = +5V, 50ohm System, Ta =  $25^{\circ}$ C

2 OIP3 is measured with two tones, at an output power of +0dBm/tone separated by 1MHz.

# CL0901-L / CL1501-L CL1801-L / CL2101-L

# **RFHIC**

# CL0901-L (Cellular)

## **S-Parameter**

H1 S1: H2 S2: H4 S2:	L L06 2 L06	10 dB/R 10 dB/R	EF 0 dB EF 0 dB		3:19.330 3:-11.066	dB 85 dB	0.000 000 MHz	1
Rm								CH1 Markers
5								1:-22.267 dB 824.000 MHz
-	850	MHz						2:-27.026 dB 894.000 MHz
	_	-		*			_	
			A 1			∆	201-1	2
+							-	
<b>C</b> =		_						-=1
Rm				30				
ے 1			A 1	ľ		<u>∆</u>	CH2 Marke 1: 19.546 824.000 M	dB
a			<u> </u>				2: 18.696 894.000 M	dB Hz
<u>ه</u>	_	-			_	2		CH4 Markers
	_						-	1:-11.056 dB 824.000 MHz
								2:-11.048 dB

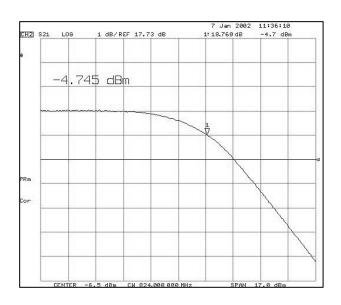
#### Mkr4 825.50 MHz Ref 10 dBm Atten 20 dB -57.09 dBm Peak Log 10 dB/ Center 824.0000000 MHz Center 824 MHz Span 5 MHz #Res BW 10 kHz #VBW 300 Hz Sweep 2.083 s (401 pts) X Axis 823.50 MHz Marker Trace Type Freq Amplitude (1) -0.071 dBm 1 824.50 MHz 822.50 MHz 825.50 MHz -0.048 dBm -53.96 dBm -57.09 dBm (1) Freq 2 3 4 (1) (1) Freq Freq

**OIP3** 

# Noise Figure

### P1dB

<b>gilent</b> 09:03:5	3 May 22,2007			Frequency
[	DUT Amplifier S	iys Downconv Of	f	Freq Mode Sweep
Freq	Nois	eFig dB (	Gain dB	Start Fre
824.0000 M			.9.195	824.000000 MH
829.0000 Mi 834.0000 Mi 839.0000 Mi 844.0000 Mi	lz 0.477 lz 0.545	1 1	.9.088 .8.935 .8.699 .8.525	Stop Fre 894.000000 MH
844.0000 M 849.0000 M 854.0000 M 859.0000 M	lz 0.539 lz 0.565	1 1	.8.347 .8.347 .8.362	Center Fre 859.000000 MH
864.0000 MH 869.0000 MH 874.0000 MH 879.0000 MH	Hz 0.510 Hz 0.560	1 1	.8.422 .8.569 .8.600 8.648	<b>Freq Spa</b> 70.0000000 MH
879.0000 Mi 884.0000 Mi 889.0000 Mi 894.0000 Mi	lz 0.602 lz 0.508	1 1	.8.576 .8.456 <b>.8.232</b>	Fixed Fred 1.50500000 GH:
824.00 MHz 302.65 K	BW 4 MHz Avgs Off	Points 15 Att Ø dB	Stop 894.00 Loss Off	MHz Corr 1 of 2



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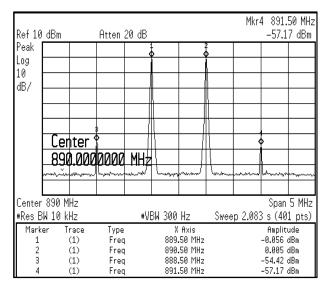
All specifications may change without notice.

# RFHIC

# **CL0901-L (GSM)**

#### 8 Jan 2002 14:15:27 3:-27.419 dB 3: 18.311 dB 3:-10.868 dB S11 S21 S22 CH1 CH2 CH4 L06 10 dB/REF 0 dB 10 dB/REF 0 dB 10 dB/REF 0 dB 930.000 000 MHz Rm CH1 Marker 1:-26.641 dB 890.000 MHz CA. 930 MHz 2:-26.078 dB 960.000 MHz 3 4 3 Mark 1 1: 18.842 dB 890.000 MHz : <u>18.117</u> dB 60.000 MHz 3 V 4 CH4 Markers 1:-10.905 dB 890.000 MHz 2:-10.830 dB 960.000 MHz

### **S-Parameter**



# **OIP3**

# **Noise Figure**

Sys Downconv Off

NoiseFig dB

0.561

0.595 0.608

0.502

0.598

0.596

0.601 0.526

0.525 Ø 546

0.553

0.538

0.559

Points 15

Att 0 dB

BW 4 MHz

Avas Off

Gain dB

18.384 18.225 18.099

18.014 17.940 17.956 17.979

17.979 17.936 17.915 17.853 17.655 17.539 17.384

17.231

Stop 960.00 MHz Loss Off Corr

# P1dB Jan 2002 11:43:50 CH2 S21 LOG 1 dB/REF 18.08 dB 1:18.097 dB -3.4 dBr -3.445 dBm Start Freq 890.000000 MHz Stop Freq Center Freq 925.000000 MHz 1 Freq Span 70.0000000 MHz **Fixed Freq** 1.50500000 GHz 1 of 2

🔆 Agilent	09:06:32	May 22,	2007

Freq

890.0000 MHz

895.0000 MHz 900.0000 MHz

905.0000 MHz 910.0000 MHz

915.0000 MHz 920.0000 MHz

925.0000 MHz 930.0000 MHz

935.0000 MHz 940.0000 MHz

945.0000 MHz

950 0000 MHz

955.0000 MHz

960.0000 MHz

Start 890.00 MHz Tcold 302.65 K

DUT Amplifier

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Frequency

Freq Mode

960.000000 MH:

Sween

More

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# CL0901-L / CL1501-L CL1801-L / CL2101-L

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# **CL1801-L (PCS)**

#### 8 Jan 2002 14:53:12 3:-19.955 dB 3:15.447 dB 1 800.000 000 MHz 3:-11.611 dB 10 dB/REF 0 dB 10 dB/REF 0 dB 10 dB/REF 0 dB CH1 S11 CH2 S21 CH4 S22 LOG ₩ PRm CH1 Markers 1:-20.101 dB 1.75000 GHz Cor 2:-19.682 dB 1.87000 GHz 1.8 GHz ∆ 1 ∆ 2 t Rm CH2 Mark 1 <u>∆</u> 2 1: 15.853 dB 1.75000 GHz 1 ∆ 2 2: 15.276 dB 1.87000 GHz Cor CH4 Markers 1:-11.328 dB 1.75000 GHz ↑ ↑ 2:-12.010 dB 1.87000 GHz

# S-Parameter

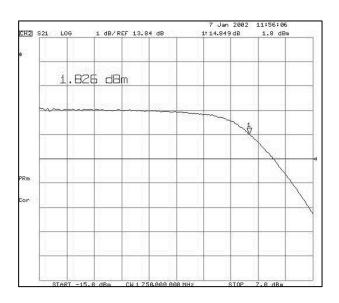
								Mkr4	1.751	50 GHz
Ref 10	∣dBm		Atten	20 dB					-58.2	1 dBm
Peak				1	5		5			
Log										
10							t			
dB/	<u> </u>				<u> </u>					
							-			
	<u> </u>						Į			
				(		(				
	l Cer	hter <	2		l				\$	
	1.7	5000	0000	GHź						
	math		mon		how	www	h-~~	man	home	www
Center	1.75 (	GHz							Span	5 MHz
#Res B	3W 10 k	Hz		#V[	3W 300	Hz	Swee	p 2.083	3 s (40	1 pts)
Mark	er T	race	Туре			Axis			Amplit	
1		(1)	Freq			950 GHz			-0.023	
2		(1) (1)	Freq Freq			350 GHz 350 GHz			-0.011 -56.75	
4		(1)	Freq			50 GHz			-58.21	
d i										

OIP3

# **Noise Figure**

Frequency			May 22, 2007	ent 09:21:36
Freq Mod Swee	Off	Sys Downconv	「Amplifier Sy	DU
Start Fre	Gain dB	eFig dB	Noise	Freq
1.75000000 G	14.537 14.734		0.544 0.578	1.750000 GHz 1.758571 GHz
Stop Fre	14.776 14.632		0.578 0.618 0.595	1.767143 GHz 1.775714 GHz
	14.434 14.286		0.553 0.553 0.567	1.784286 GHz 1.792857 GHz
Center Fre 1.81000000 G	14.272 14.348		0.518 0.518 0.557	1.801429 GHz 1.810000 GHz
Freq Spa	14.375 14.298		0.559 0.582	1.818571 GHz 1.827143 GHz
120.000000 M	14.045		0.600	1.835714 GHz
Fixed Fre	13.805 13.713		0.593 0.557	1.844286 GHz 1.852857 GHz
1.50500000 G	13.777 14.003		0.570 0.579	1.861429 GHz 1.870000 GHz
Mor	Stop 1.87000 GHz	Points 15	BW 4 MHz	.75000 GHz
1 of	Loss Off Corr	Att 0 dB	Avgs Off	

### P1dB



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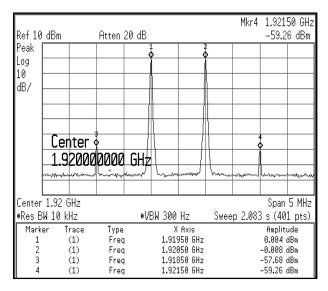
# CL0901-L / CL1501-LLow Noise AmplifierCL1801-L / CL2101-L

# **RFHIC**

# CL2101-L (IMT2000)

0H1 S11 0H2 S21 0H4 S21	L LOG L LOG 2 LOG	10 dB/REF 10 dB/REF 10 dB/REF	0 dB 0 dB 0 dB	31-	Jan 20 18.919 d 4.022 dE 13.393 d	в	48:19 .000 000 MHz	2
Rm								CH1 Markers
or	2.1	GHz			_			1:-19.659 dB 1.92000 GHz 2:-18.475 dB 2.17000 GHz
	Δ 1				3 7	-2	2	-2
Rm					3		CH2 Marki	a rs
or 1-					3 7 7 7	-	11 14.831 192099 2 13.610 2.17000	Hz
ir _								CH4 Markers 1:-12.342 dE 1.92000 GHz
t t								2:-13.913 dB 2.17000 GHz

### **S-Parameter**

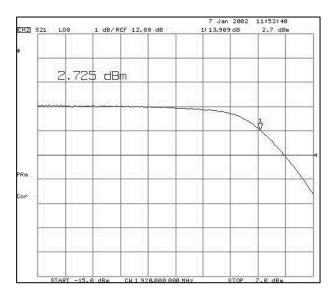


**OIP3** 

# Noise Figure

#### P1dB

<b>ent</b> 09:27:58 May 1	22, 2007		Frequency
DUT Amp	lifier Sys Downco	nv Off	Freq Mod Swe
Freq	NoiseFig dE	3 Gain dB	Start Fr
1.920000 GHz	0.700	13.654	1.92000000
1.937857 GHz 1.955714 GHz	0.790 0.739	13.786 13.665	Stop Fr
1.973571 GHz 1.991429 GHz	0.703 0.765	13.660 13.628	2.17000000 (
2.009286 GHz 2.027143 GHz	0.735 0.776	13.381 13.226	Center Fr 2.04500000
2.045000 GHz 2.062857 GHz	0.720 0.721	13.416 13.224	2.04300000
2.080714 GHz 2.098571 GHz	0.685 0.720	13.027 13.119	250.000000 N
2.116429 GHz	0.698	13.245	
2.134286 GHz 2.152143 GHz	0.747 0.655	12.891 <u>12.908</u>	Fixed Fr 1.50500000 (
2.170000 GHz	0.658	13.062	
.92000 GHz BW 4 03.15 K Avgs			GHz Mo Corr 1 of

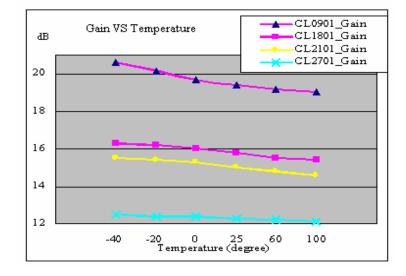


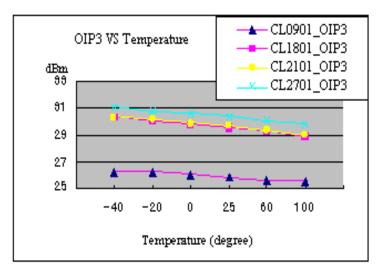
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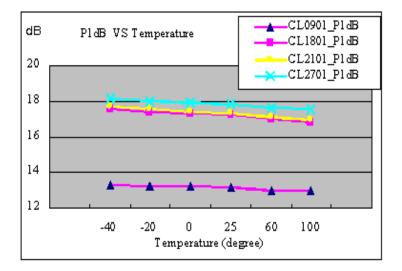
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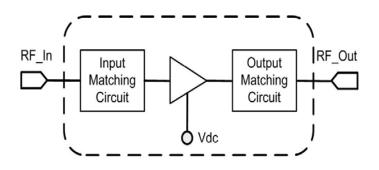


# **Absolute Maximum Ratings\***

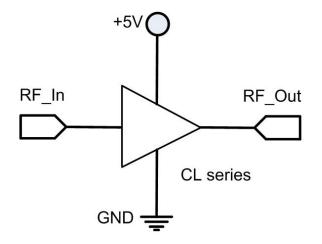
PARAMETER	Unit	Rating	Remark
Device Voltage	V	+8	
RF Input Power	dBm	+25	
Operating Temperature	°C	-40 to +85	
Storage Temperature	Ĵ	-50 to +125	

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

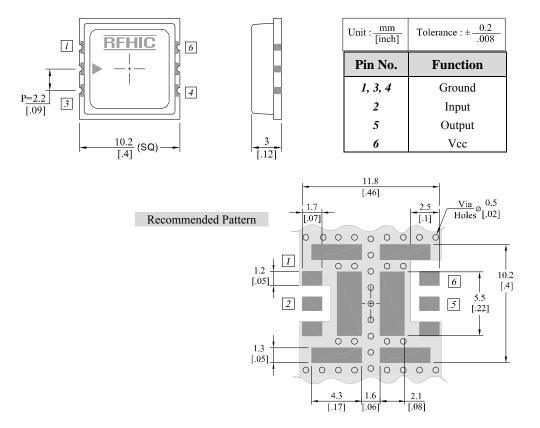
### **Functional Diagram**



# **Application Circuit**



### Package Dimensions (Type: CP-16A)



#### **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.

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