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

<u>RFHIC</u>

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



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.

PARAMETER	UNIT	CL09	901-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 ₂₁)	dB	19	18	16	15.5	14
Gain Flatness	dB	±0.5	±0.5	±0.5	±0.5	±1.0
Input Return Loss (S ₁₁)	dB	-18	-18	-18	-18	-18
Output Return Loss (S ₂₂)	dB	-10	-10	-10	-10	-10
1dB Compression Point (P ₁ dB)	dBm	14	14	15	16	16
Output 3 rd 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

Electrical Specifications

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.

CL1801-L / CL2101-L

RFH

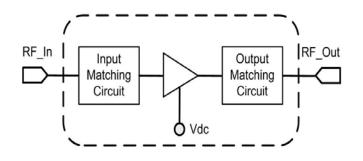
Absolute Maximum Ratings

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

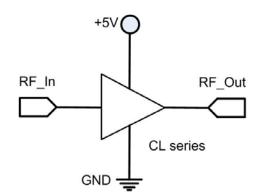
Note

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. _

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

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CL0901-L~(Cellular)

S-Parameter

CH1 S CH2 S CH4 S	11 L06 21 L06 22 L06	10 dB/ 10 dB/ 10 dB/	REF 0 dB REF 0 dB REF 0 dB	10	3-24.209 dB	14:17:34 850.000 000 MHz	1
Rm							CH1 Markers
4		0 MHz					1:-22.267 dB 824.000 MHz
			9				2-27.026 dB 894.000 MHz
			Δ 1	<u> </u>	Δ		2
t							
c⇒ ≷m				3			-=1
۵ 1 1		_	Å		<u>∆</u>	012 Marke 1: 19.546 824.000 M	dB
			<u>A</u>	-¥		2: 18.696 894.000 M	dB Hz
4					2		CH4 Markers 1:-11.056 dB
ŧ							824.000 MHz 24-11.048 dB 894.000 MHz
L	START	750.000 000	MH2		STOP 95	6.000 000 MHz	1

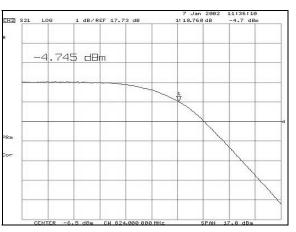
OIP3

Ref 10	dBm		Atten	20 dB				Mkr		50 MHz 19 dBm
Peak				, i	>		2			
Log 10										
dB/										
					ļ					
		nter `	Ĺ							
	824	4.000	0000	MHz			Ц		1	
	***		him	m	han	m	mon	man	have	****
	824 M									5 MHz
#Res B	W 10 k	Hz		#V{	3W 300	Hz	Swee	p 2.083	3 s (40	1 pts)
Mark		race	Type			Axis			Amplit	
1		(1)	Free			50 MHz			-0.071	
2		(1) (1)	Frec Frec			.50 MHz .50 MHz			-0.048 -53.96	
4			Fred			50 MHz			-57.09	

Noise Figure

✗ Agilent 09:03:53 May 2	2, 2007		Frequency
DUT Ampli	fier Sys Downconv	Off	Freq Mode Sweep
Freq 824,0000 MHz 834,0000 MHz 834,0000 MHz 839,0000 MHz 849,0000 MHz 859,0000 MHz 859,0000 MHz 859,0000 MHz 869,0000 MHz 879,0000 MHz 879,0000 MHz 889,0000 MHz 889,0000 MHz 889,0000 MHz 889,0000 MHz	NoiseFig dB 0.610 0.599 0.477 0.524 0.524 0.555 0.551 0.574 0.510 0.560 0.574 0.550 0.574 0.550 0.551 0.574 0.550 0.551 0.574 0.550 0.550 0.551 0.574 0.550 0.550 0.551 0.574 0.550 0.560 0.550 0.550 0.551 0.574 0.550 0.560 0.5	Gain dB 19.195 19.088 18.935 18.525 18.407 18.347 18.347 18.362 18.422 18.569 18.600 18.648 18.576 18.456 18.456	Start Free 824.000000 MHz Stop Free 834.000000 MHz Center Free 859.000000 MHz Freq Spar 70.0000000 MHz Fixed Free 1.50500000 GHz
Start 824.00 MHz BW 4 M Tcold 302.65 K Avgs 0		Stop 894.00 MHz Loss Off Corr	More 1 of 2

P1dB



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

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CL0901-L (GSM)

S-Parameter

H1 S1 H2 S2 H4 S2	1 L06 1 L06 2 L06	10 dB/R 10 dB/R 10 dB/R	EF 0 dB EF 0 dB EF 0 dB		8 Jan 3:-27.419 3:18.311 3:-10.868	dB	.5:27 900 000 MHz	1
Rm								CH1 Markers
	930	MHz			1			1:-26.641 dE 890.000 MHz 2:-26.078 dE 960.000 MHz
				<u>A</u>	3	<u></u>		2
Rm					3			
▲ [<u>م</u>		<u>∆</u> 2	CH2 Mark 1: 18.842 890.000	dB
				<u>4</u>	<u>3</u>	<u>Å</u>	2: 18.117 	dB Hz
								CH4 Markers 1:-10.905 dB 890.000 MHz
								2:-10.830 dB 960.000 MHz

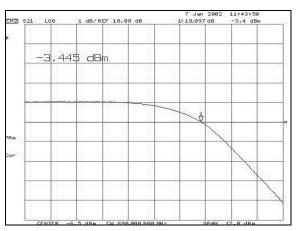
Mkr4 891.50 MHz -57.17 dBm Ref 10 dBm Atten 20 dB Peak Log 10 dB/ Center 890.0000000 MHz ſ JL ~~~ Center 890 MHz Span 5 MHz Sweep 2.083 s (401 pts) #Res BW 10 kHz #VBW 300 Hz X Axis 889.50 MHz 890.50 MHz 888.50 MHz 888.50 MHz 891.50 MHz Amplitude -0.056 dBm 0.005 dBm -54.42 dBm -57.17 dBm Trace (1) (1) (1) (1) (1) Type Freq Freq Freq Freq Marker 2

OIP3

Noise Figure

Frequency			May 22, 2007	lent 09:06:32
Freq Mode Sweep	f	ys Downconv	Amplifier Sy	DUT
Start Fred	Gain dB	eFig dB	Noise	Freq
890.000000 MH2	18.384 18.225 18.099		0.561 0.595 0.608	890.0000 MHz 895.0000 MHz 900.0000 MHz
960.000000 MH2	18.014 17.940 17.956 17.979		0.502 0.575 0.598 0.596	905.0000 MHz 910.0000 MHz 915.0000 MHz 920.0000 MHz
925.000000 MHz	17.936 17.915 17.853		0.601 0.526 0.525	925.0000 MHz 930.0000 MHz 935.0000 MHz
70.0000000 MHz Fixed Fred	17.655 17.539 17.384 17.292		0.546 0.553 0.538 0.512	940.0000 MHz 945.0000 MHz 950.0000 MHz 955.0000 MHz
1.50500000 GHz More	17.232 17.231 Stop 960.00 MHz	Points 15	0.512 0.559 3W 4 MHz	960.0000 MHz
1 of 2	Loss Off Corr	Att 0 dB	Avgs Off	

P1dB



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

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$CL1801\text{-}L\ (\text{PCS})$

S-Parameter

0H1 S11 0H2 S21 0H4 S22	L06 L06 L06	10 dB/RE 10 dB/RE 10 dB/RE	F 0 dB F 0 dB F 0 dB		8 Jan 3:-19.95 3:15.44 3:-11.61	5 dB	800.000	2 000 MHz	1
Rm									CH1 Markers
or	1.8	GHz							1:-20.101 dB 1.75000 GHz 2:-19.682 dB 1.87000 GHz
_	_			<u> </u>			<u>A</u>		-2
† (=							~		-=1
Rm				3					
or		∆ 1		3			A 2	H2 Mark (1: 15.853 1.75000 (dB
1		Å		ľ			∆ 2	2:15.276 1.87000 (dB Hz
or _							-		CH4 Markers 1:-11.328 dB
t									1.75000 GHz 2:-12.010 dB 1.87000 GHz
-	START 1 7	00.000 000 M	Hz		-	STOP 1 9P	0 000 0	00 MHZ	

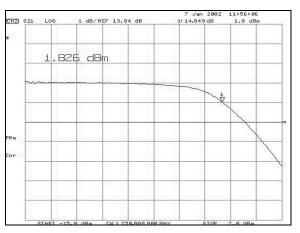
Mkr4 1.75150 GHz -58.21 dBm Ref 10 dBm Atten 20 dB Peak Log 10 dB/ Center 🛉 1.750000000 GHz Span 5 MHz Center 1.75 GHz #VBW 300 Hz Sweep 2.083 s (401 pts) #Res BW 10 kHz X Axis 1.74950 GHz 1.75050 GHz 1.74850 GHz 1.75150 GHz Amplitude -0.023 dBm -0.011 dBm -56.75 dBm -58.21 dBm Trace (1) (1) (1) (1) (1) Type Freq Freq Freq Freq Marker 3

OIP3

Noise Figure

gilent 09:21:36 May 2	2,2007		Frequency
DUT Ampl	fier Sys Downconv	Off	Freq Mode Sweep
Freq	NoiseFig dB	Gain dB	Start Fred
1.750000 GHz 1.758571 GHz	0.544 0.578	14.537 14.734	1.75000000 GH:
1.767143 GHz 1.767144 GHz 1.775714 GHz 1.784286 GHz	0.578 0.618 0.595 0.553	14.776 14.632 14.434	Stop Fred 1.87000000 GH:
1.792857 GHz 1.801429 GHz 1.810000 GHz	0.567 0.518 0.557	14.286 14.272 14.348	Center Fred 1.81000000 GH;
1.818571 GHz 1.827143 GHz 1.835714 GHz 1.844286 GHz	0.559 0.582 0.600 0.593	14.375 14.298 14.045 13.805	Freq Spar 120.000000 MH;
1.852857 GHz 1.861429 GHz 1.870000 GHz	0.557 0.570 0.579	13.713 13.777 14.003	Fixed Fred 1.50500000 GHz
1.75000 GHz BW 4 M 303.15 K Avgs (Stop 1.87000 GHz Loss Off Corr	More 1 of 2

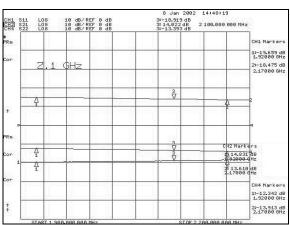
P1dB



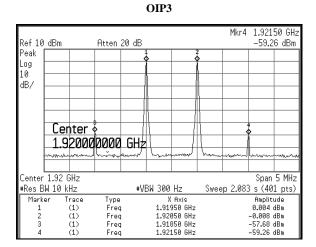
CL0901-L / CL1501-L CL1801-L / CL2101-L

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CL2101-L (IMT2000)



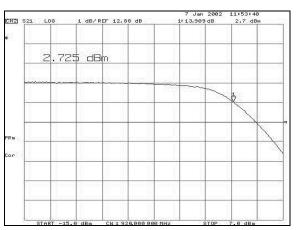
S-Parameter



Noise Figure

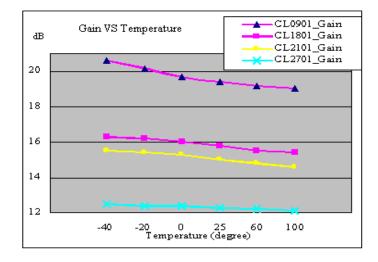
Agilent 09:27:58 May 2	2,2007		Frequency
DUT Ampl	fier Sys Downconv	Off	Freq Mode Sweep
Freq	NoiseFig dB	Gain dB	Start Freq 1.92000000 GHz
1.920000 GHz 1.937857 GHz 1.955714 GHz 1.973571 GHz	0.700 0.790 0.739 0.703	13.654 13.786 13.665 13.660	Stop Freq 2.17000000 GHz
1.991429 GHz 2.009286 GHz 2.027143 GHz 2.0450000 GHz	0.765 0.735 0.776 0.720	13.628 13.381 13.226 13.416	Center Freq 2.04500000 GHz
2.062857 GHz 2.080714 GHz 2.098571 GHz 2.116429 GHz	0.721 0.685 0.720 0.698	13.224 13.027 13.119 13.245	Freq Span 250.000000 MHz
2.134286 GHz 2.152143 GHz 2.1700000 GHz	0.747 0.655 0.658	12.891 12.908 13.062	Fixed Freq 1.50500000 GHz
tart 1.92000 GHz BW 4 M cold 303.15 K Avgs (Stop 2.17000 GHz Loss Off Corr	More 1 of 2

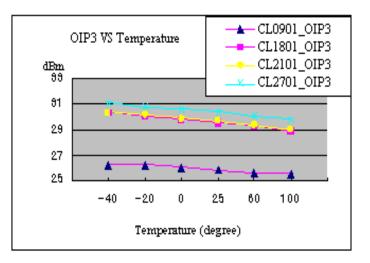
P1dB

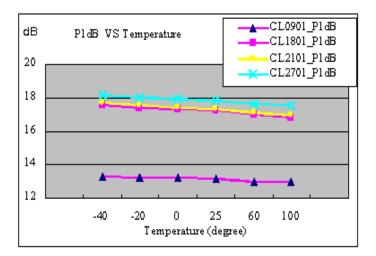


CL0901-L / CL1501-L CL1801-L / CL2101-L

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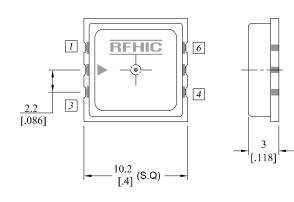


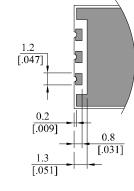
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Package Dimensions (Type: CP-16A)

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





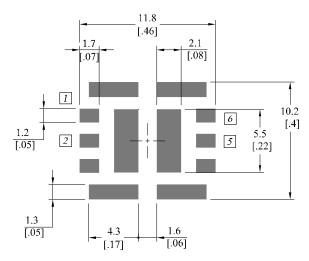
Top View

Side View

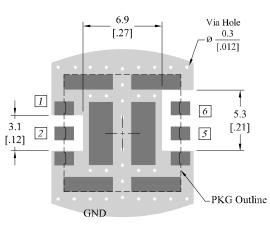
▲ Bottom View

Pin Description								
Pin No	Pin No Function		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.

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



Revision History

Part Number	Release Date	Version	Modification	Data Sheet Status
CL0901-L CL1501-L CL1801-L CL2101-L	2012.10.19	6.3	New datasheet format	-
CL0901-L CL1501-L CL1801-L CL2101-L	2012.2.18	6.2	-	-

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