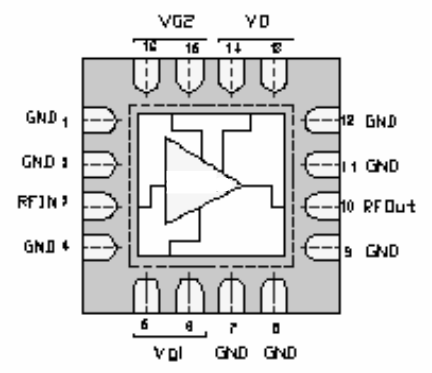
0.8– 4 GHz Frequency Tunable Ultra Low Noise Amplifier

Features

- **Frequency Range: 0.8- 4 GHz**
- **0.70 dB typ. NF**
- **Tunable Noise match**
- **20 dB Gain**
- **14dBm Nominal P1dB**
- **On-chip DC Blocks**
- **10-70mA Tunable Bias current**
- **0.15-um InGaAs pHEMT Technology**
- **16-Pin QFN Plastic Package : 3mmx3mmx1mm**

Functional Diagram



Typical Applications

- **Receiver Front End**
- **GSM/DCS/PCN/PCS, CDMA, WCDMA Base stations**
- **GPRS, EDGE**
- **DECT**

Description

ASL1005P3 is an Ultra Low Noise single stage GaAs MMIC Amplifier combining high gain and state of the art noise figure for GSM/CDMA/WCDMA applications. Excellent 0.7dB Noise Figure (RF connector loss included) can be achieved in these bands. External tuned inductor enables optimum noise figure match and flexibility in frequency band of operation within 0.8-4.0 GHz band. The LNA features 20dB gain with good I/O VSWR in the tuned band. It also features on-chip DC Blocks and biasing flexibility to provide control over current consumption and dynamic range. The device can operate over 10-70mA Drain current and 3-7V VDD as per specific requirements with minor variation in RF Performance. The die is fabricated using reliable Low noise 0.15um InGaAs pHEMT process. This chip is available in low cost 16 pin QFN plastic package.

Absolute Maximum Ratings (1)

Parameter	Absolute Maximum	Units
Positive DC Supply	7	V
RF Input Power	23	dBm
Supply current	100	mA
Operating Temperature	-55 to +85	°C
Storage Temperature	-65 to +150	°C

1. Operation beyond these limits may cause permanent damage to the component

Electrical Specifications @ T_A = 25 °C, Z_o =50 Ω

Vd = +5V, Vg1=-0.3V, Vg2=+2V

Parameter		Frequency									Units
		800	900	1280	1575	1800	1900	2170	2400	2700	MHz
Gain		22	22.5	21	20.5	20.5	20.5	20.5	20	20	dB
Noise Figure		0.9 (1.2)	0.75 (0.9)	0.7	0.7	0.7	0.7	0.7	0.7	0.65	dB
I/P Return Loss		-5.5 (-10.5)(1)	-2.7 (-10) (1)	-11.5	-10	-12.5	-14	-13	-17	-13	dB
O/P Return Loss		-7.5	-7.8	-11.5	-17	-20	-20	-17	-16	-11	dB
Reverse Isolation		-44	-43	-40	-39	-39	-38	-37	-36	-36	dB
P1dB		13	13	13	13	14	14	14	14	14	dBm
OIP3(2)		30	30	30	30	30	30	30	30	30	dBm
Supply Current(3)		50	50	50	50	50	50	50	50	50	mA
Tuning Inductor value	@ Vg	16 (12.4)	16 (12.4)	5.6	3.6	1.8	1.6	1.6	1.6	1.6V	nH
	@ Vd	6.8	6.8	6.8	6.8	6.8	5.6	5.6	0	0	
Tuning Inductor Part No.	@ Vg	MCI Gold Coil	MCI Gold Coil	0603CS-5N6XGL	0603CS-3N6XGL	0603CS-1N8XGL	0603CS-1N6XGL	0603CS-1N6XGL	0603CS-1N6XGL	0603CS-1N6XGL	--
	@ Vd	0603CS-6N8XGL	0603CS-6N8XGL	0603CS-6N8XGL	0603CS-6N8XGL	0603CS-6N8XGL	0603CS-5N6XGL	0603CS-5N6XGL	0	0	--

Note :

1. Specs in brackets correspond to Inductor values shown in brackets
2. Estimated performance
3. The supply current is tunable between 10-70mA with minor variation in RF Performance

Electrical Specifications @ T_A = 25 °C, Z_o =50 Ω

Vd = +5V, Vg1=-0.3V, Vg2=+2V

Parameter		Frequency Bands							Unit
		1.2-1.3	1.3-1.5	1.5-1.6	1.6-1.8	1.8-1.9	1.9-2.5	2.2-2.7	GHz
Gain		21	21	21	20.5	20.5	20.5	20	dB
Noise Figure		0.8	0.8	0.7	0.85	0.7	0.7	0.7	dB
I/P Return Loss		-10	-8	-9.5	-12	-12.5	-10	-13	dB
O/P Return Loss		-10.5	-12.5	-15.5	-20	-17.5	-12	-11.5	dB
Reverse Isolation		-40	-40	-39.5	-38.5	-38.5	-37	-36.5	dB
P1dB		13	13	13	13	14	14	14	dBm
OIP3[1]		30	30	30	30	30	30	30	dBm
Supply Current[2]		50	50	50	50	50	50	50	mA
Tuning Inductor value	@ Vg	5.6	4.3	3.6	2.2	1.8	1.6	0.9	nH
	@ Vd	6.8	6.8	6.8	6.8	6.8	5.6	0	nH
Tuning Inductor Part No.	@ Vg	0603CS-5N6XGL,	0603CS-4N3XGL,	0603CS-3N6XGL,	0603CS-2N2XGL,	0603CS-1N8XGL,	0603CS-1N6XGL,	0603CS-1N6XGL // 0603CS-2N2XGL	--
	@ Vd	0603CS-6N8XGL	0603CS-6N8XGL	0603CS-6N8XGL	0603CS-6N8XGL	0603CS-6N8XGL	0603CS-5N6XGL	--	--

Note :

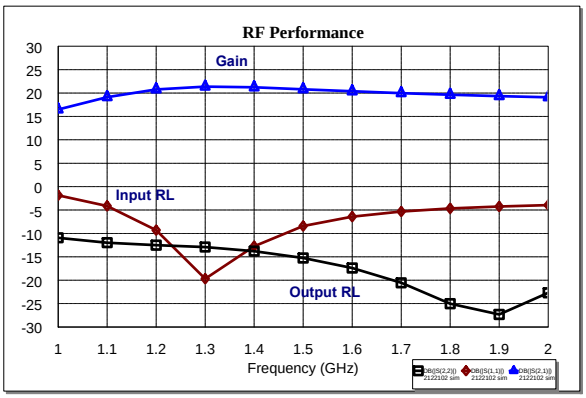
1. Estimated performance
2. The supply current is tunable between 10-70mA with minor variation in RF Performance

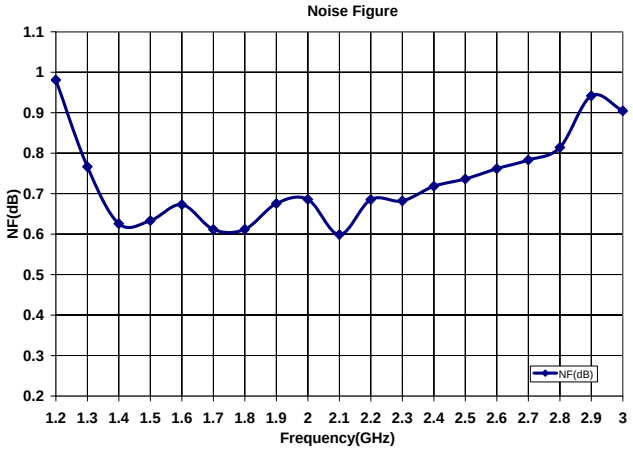
Measured Test Fixture data

Vd =+5V, Vg1= -0.3V, Vg2=+2V, Total Current = 50mA, T_A = 25 °C

1.2-1.5 GHz Band Application

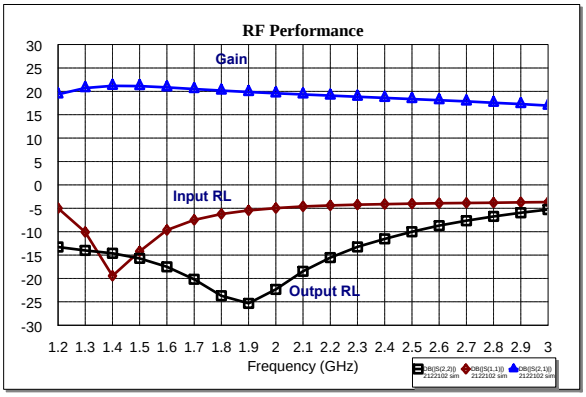
(Tuning Inductor values: @Vg1=4.3nH, @Vd= 6.8 nH)

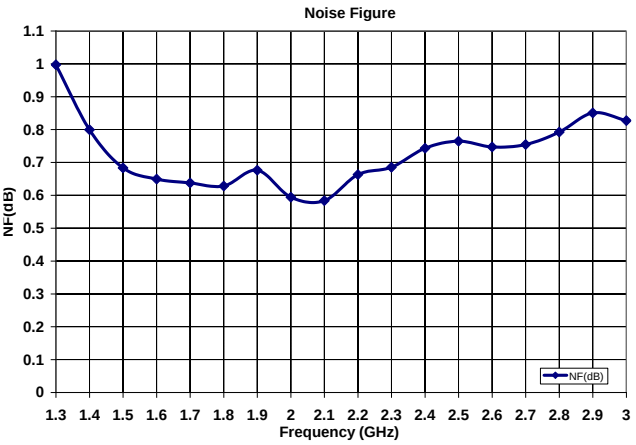




1.3-1.6 GHz Band Application

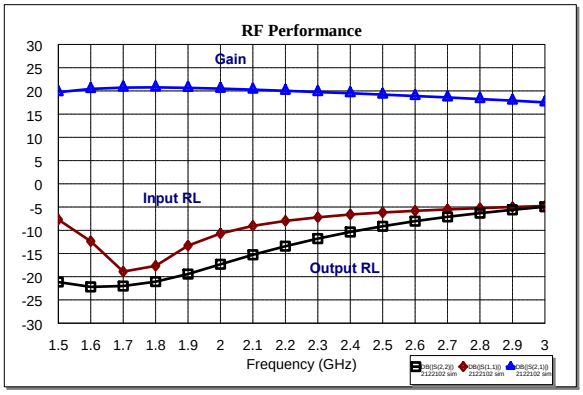
(Tuning Inductor values: @Vg1=3.6nH, @Vd= 6.8 nH)

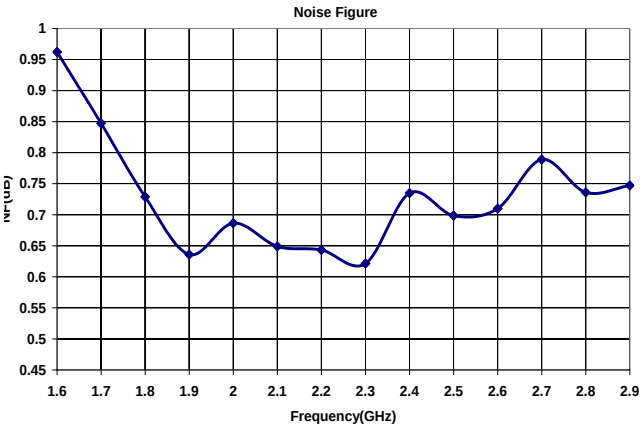




1.6-2.1 GHz Band Application

(Tuning Inductor values: @Vg1=2.2nH, @Vd= 6.8 nH)



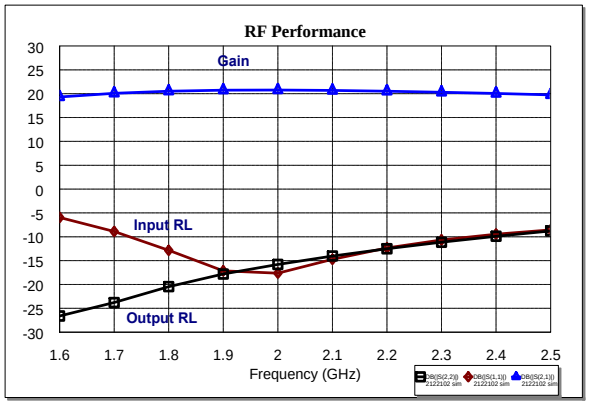


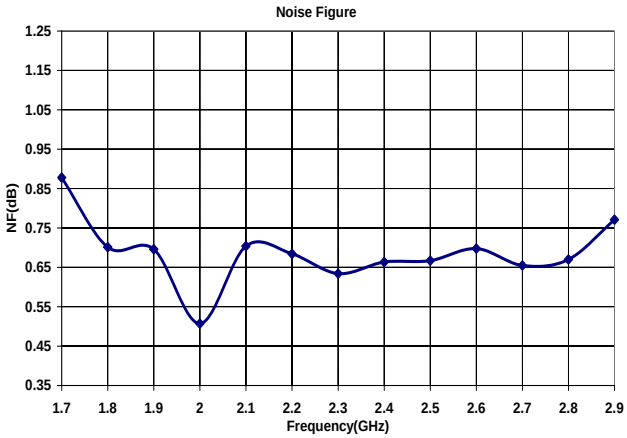
Measured Test Fixture data

Vd =+5V, Vg1=-0.3V, Vg2=+2V, Total Current = 50mA, T_A = 25 °C

1.7-2.4 GHz Applications

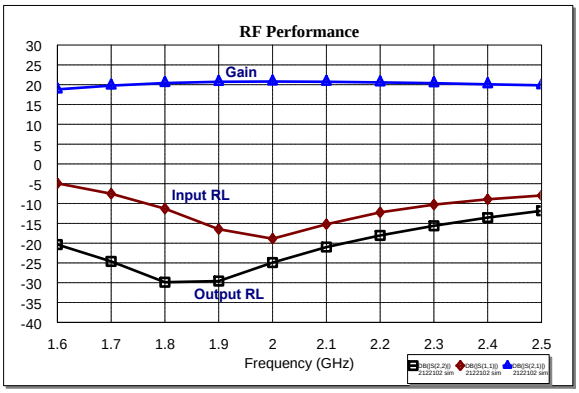
(Tuning Inductor values @Vg1=1.8nH, @Vd= 6.8 nH)

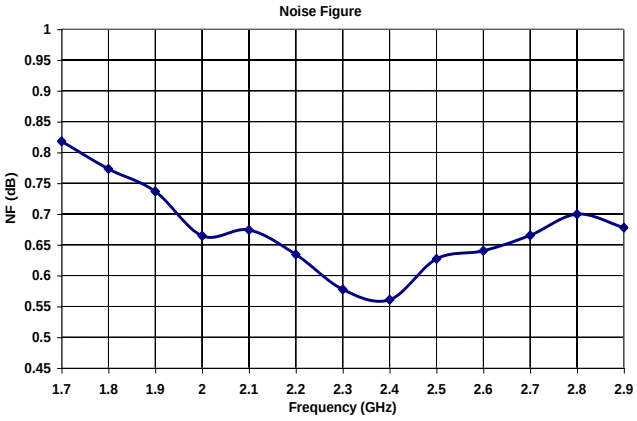




1.8-2.5 GHz Applications

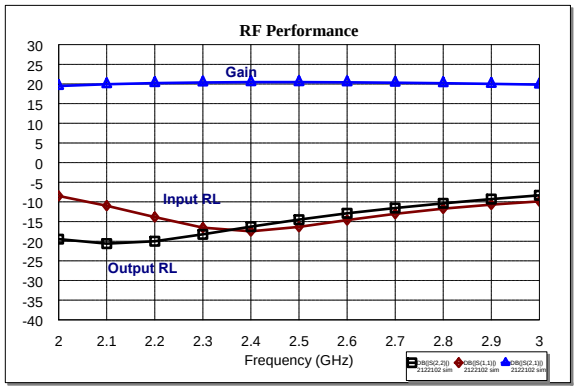
(Tuning Inductor values @Vg1=1.6nH, @Vd= 5.6 nH)

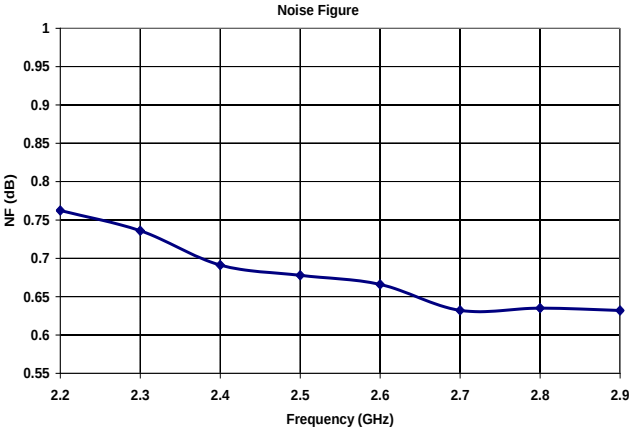




2.1-3 GHz Applications

(Tuning Inductor values @Vg1=0.9nH, @Vd = 0 nH)



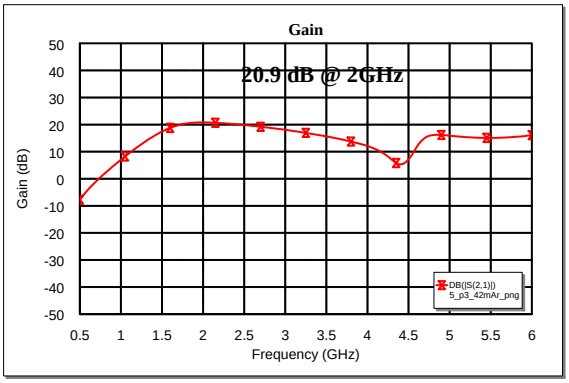


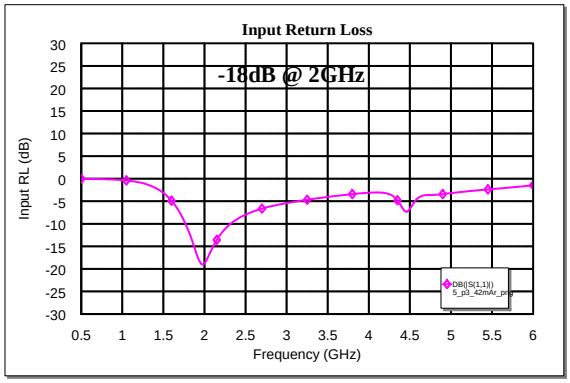
Measured Test Fixture data

Vd =+5V, Vg1=-0.3V, Vg2=+2V, Total Current = 50mA, T_A = 25 °C

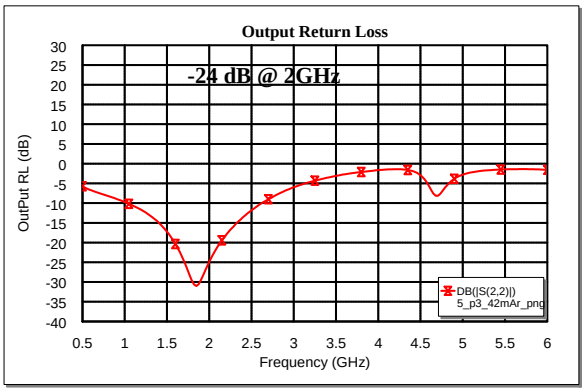
Broad Band Performance Plots

1.8-2.5 GHz Band Application (1.6 & 5.6nH)

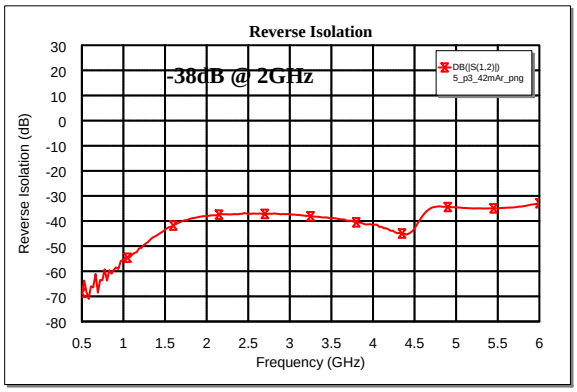




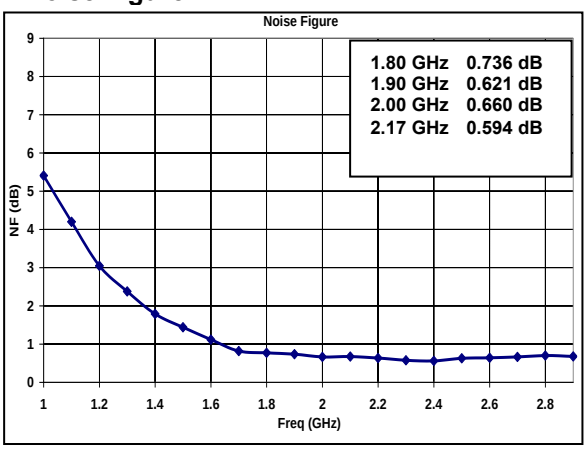
Output Return Loss



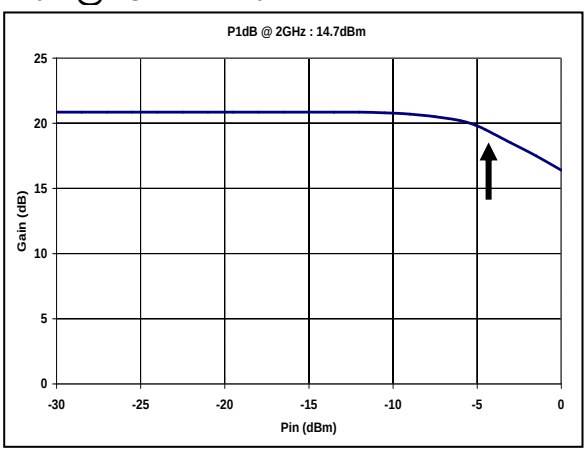
Reverse Isolation



Noise Figure



P1dB @ 2GHz : 14.7dBm



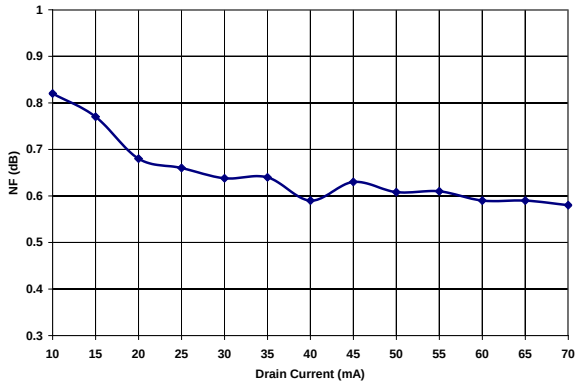
Measured Test Fixture data

T_A = 25 °C

Noise Figure and Gain variation with bias voltage/current

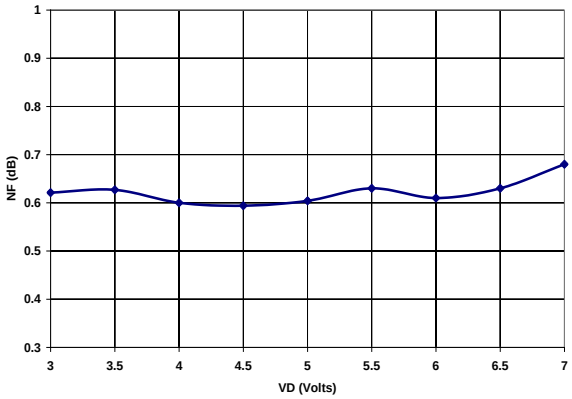
1.8-2.5 GHz Band Application

Noise Figure @ 2GHz Vs Drain Current



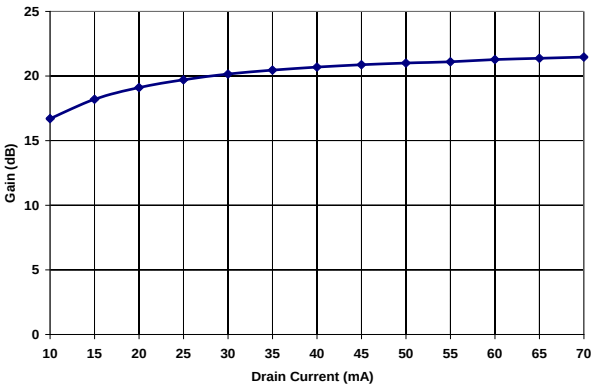
Vd =+5V, Vg1 varied from -0.5V to -0.23V, Vg2 derived from Vd,

Noise Figure @ 2GHz Vs Drain Voltage



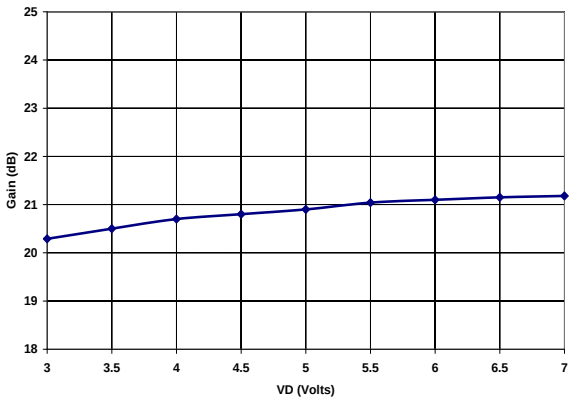
Vg1=-0.3V, Vg2 derived from Vd

Gain @ 2GHz Vs Drain Current



Vd =+5V, Vg1 varied from -0.5V to -0.23V, Vg2 derived from Vd,

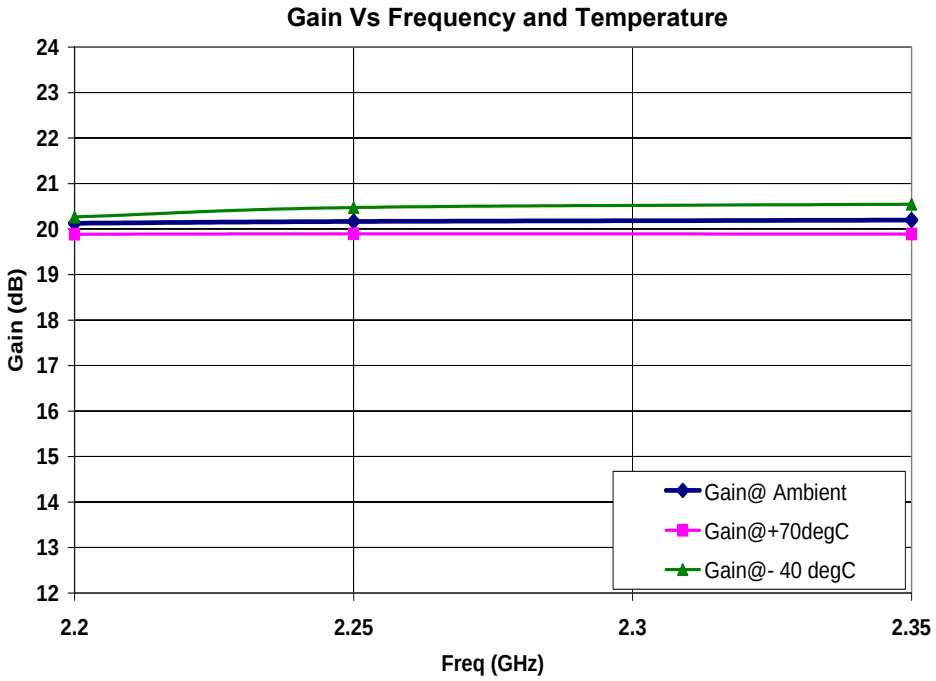
Gain @ 2GHz Vs Drain Voltage

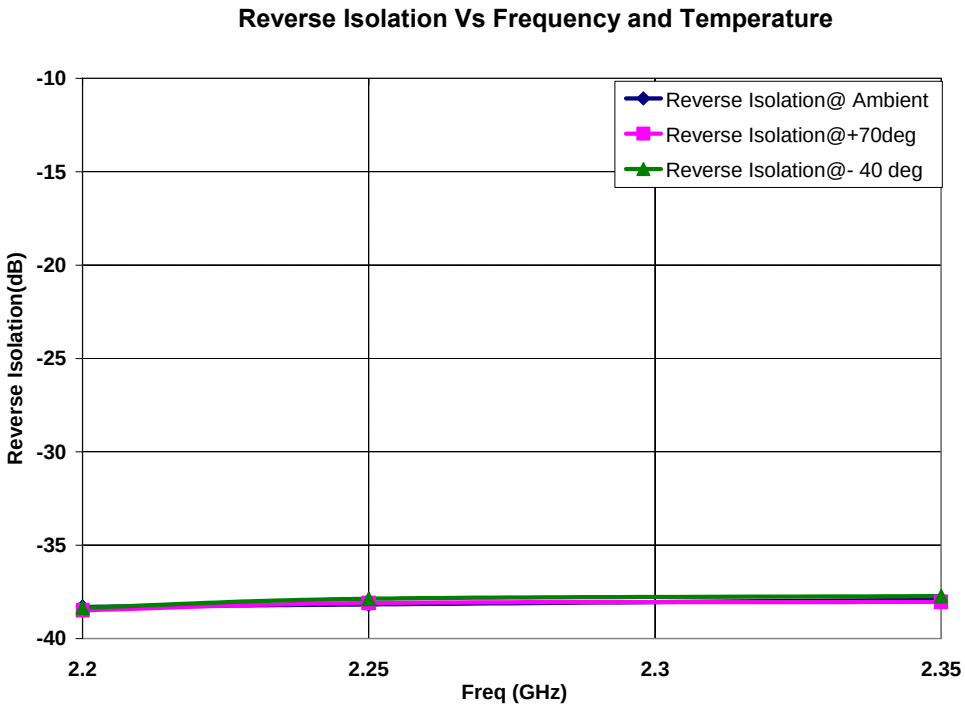


Vg1=-0.3V, Vg2 derived from Vd,

Measured Test Fixture data Over Temperature

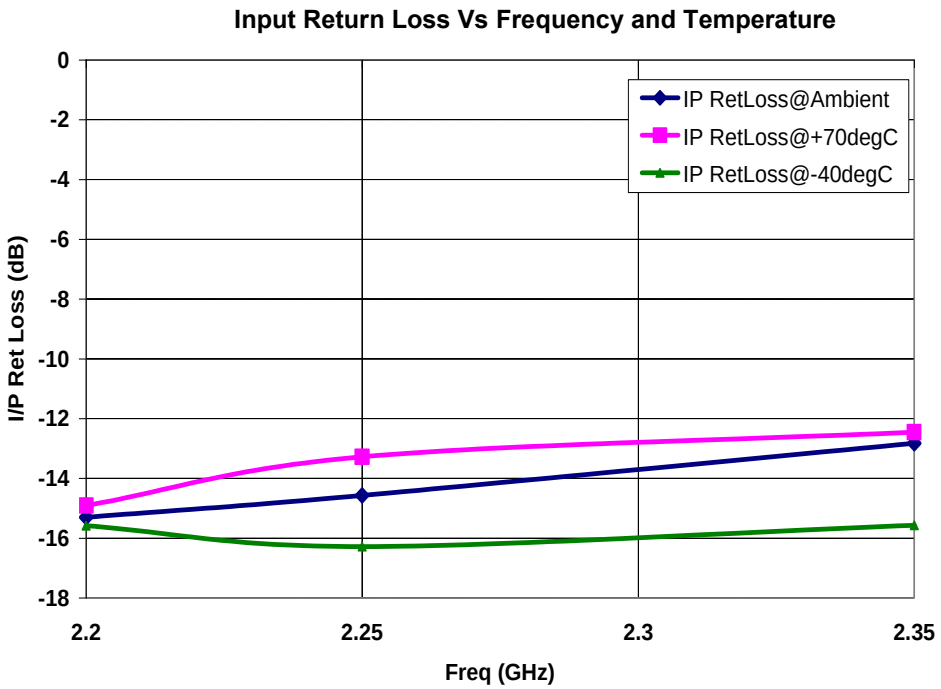
Vd =+5V, Vg1=-0.3V, Vg2=+2V, Total Current = 50mA@25 °C

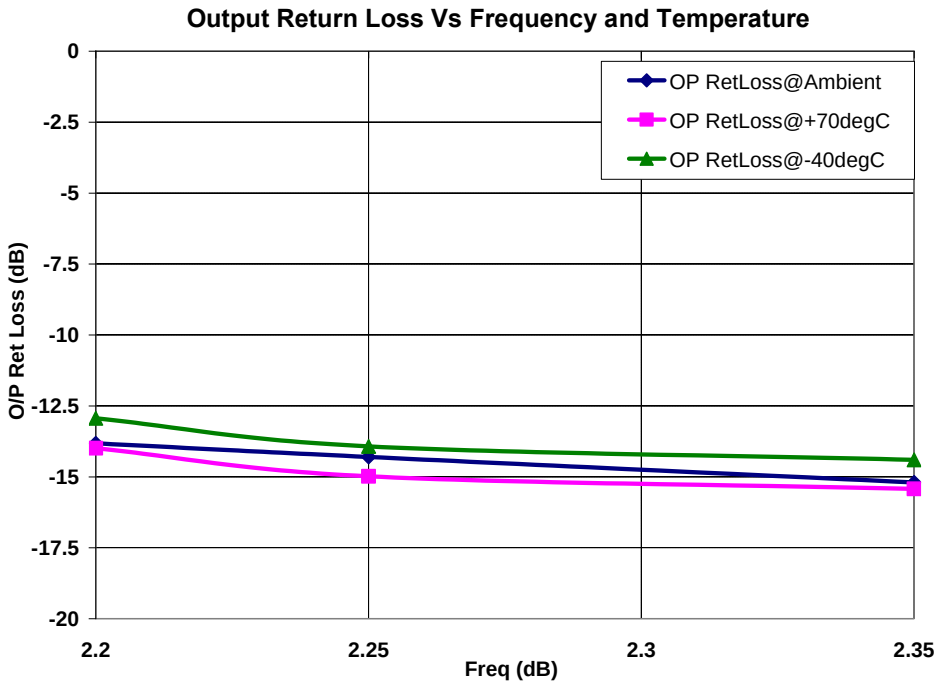




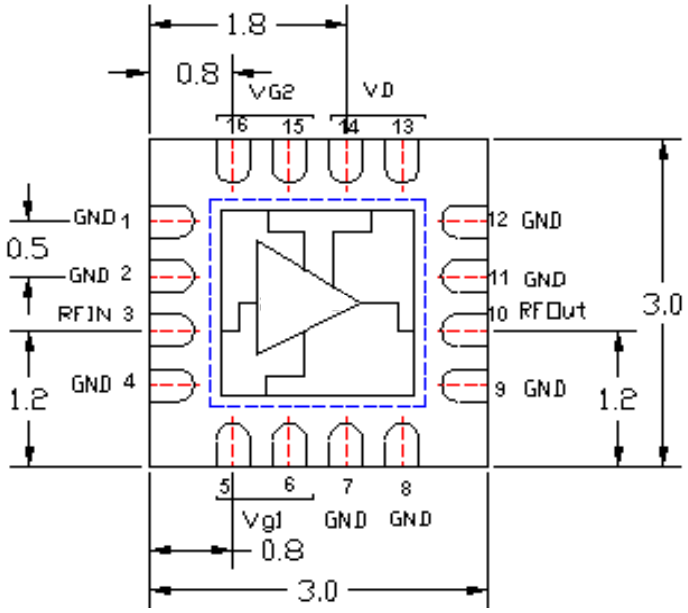
Measured Test Fixture data Over Temperature

Vd =+5V, Vg1=-0.3V, Vg2=+2V, Total Current = 50mA@25 °C





Mechanical Characteristics
(16 Pin 3mmx 3mm x 1mm QFN Package)

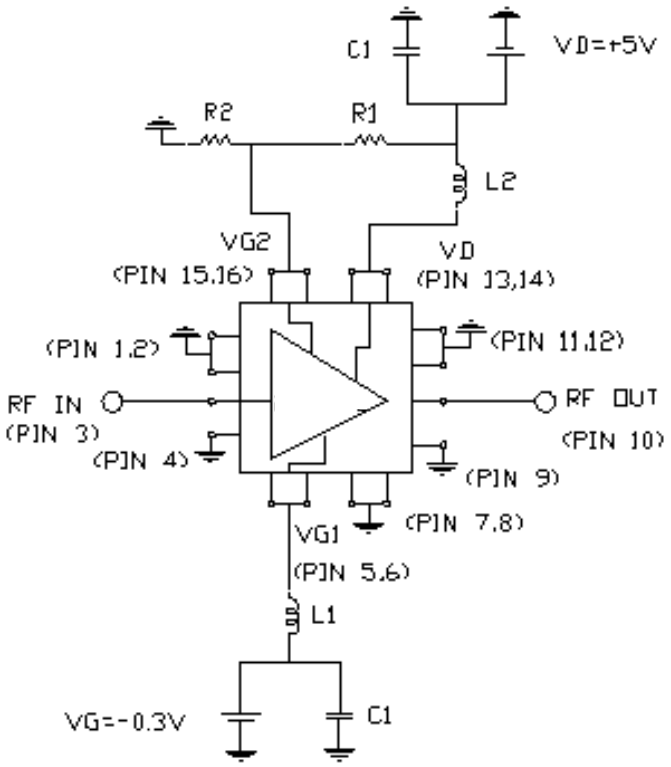


nits: millimeters

n Description:

Pin 3	: RF in
Pin 5, 6	: Gate Bias 1
Pin10	: RF out
Pin 13, 14	: Drain Bias
Pin 15, 16	: Gate Bias2
Pin 1,2,4,7,8,9,11,12	: Ground

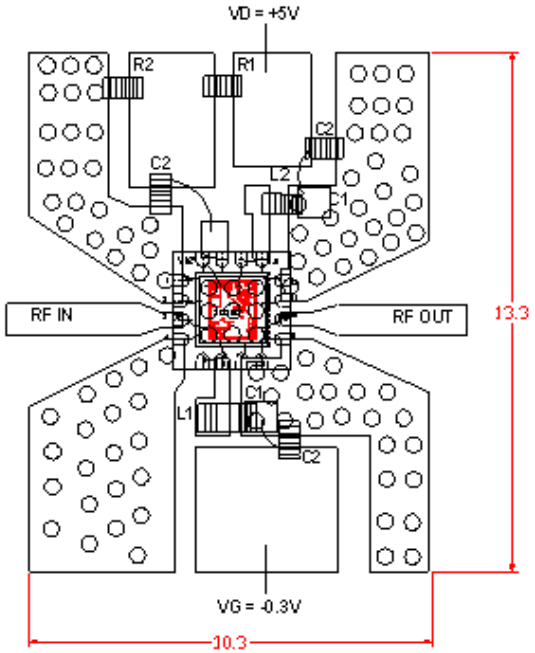
Application Circuit



Note :

1. Value of L1 & L2 should be chosen as per the operating band, as suggested under “Electrical Specifications” .
2. The First Bypass capacitor C1 ~ 470pF
3. R1=15K, R2=10K
4. 0.1uF should be used as 2nd Bypass Capacitor

Evaluation PCB



Units: millimetres

List of Components

Component ID	Value	Description / Part No.
C1	470 pF	Bypass capacitor / ATC Dicap 116UK471M100TT or equivalent
C2	0.1 uF	2nd Bypass Capacitor (0402 Pkg.)
R1	15K Ohm	Resistor in VG2 Bias network (0402 Pkg.)
R2	10K Ohm	Resistor in VG2 Bias network (0402 Pkg.)
L1 & L2	As per the Table "Electrical Specifications"	Freq. Band Tuning Inductors, 0603 Pkg. or Gold Coil
Board Material : RT/ Duroid 5880		

Note:

1. Input and Output Lines should be of 50Ω I mpedance.
2. Sufficient numbers of via holes should be provided for good grounding.
3. 1st bypass of 470 pF should be present immediately after the chip inductors.
4. Vg2 can be applied independently without using R1 & R2.
5. Gold Coils can be used instead of chip inductors, with values as per the table.
6. Two 1-mil (0.0254mm) bond wires of minimum length should be used for RF input and Output.
7. Evaluation PCB is available from ASL upon request.

GaAs MMIC devices are susceptible to Electrostatic discharge. Proper precautions should be observed during handling, assembly & testing