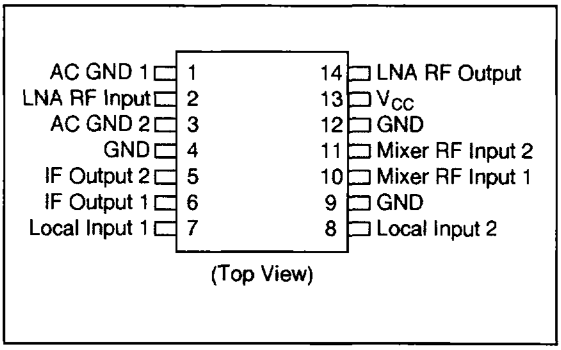
HA22001T

Mobile Communication Receiver GaAs Monolithic IC (LNA+MIX)

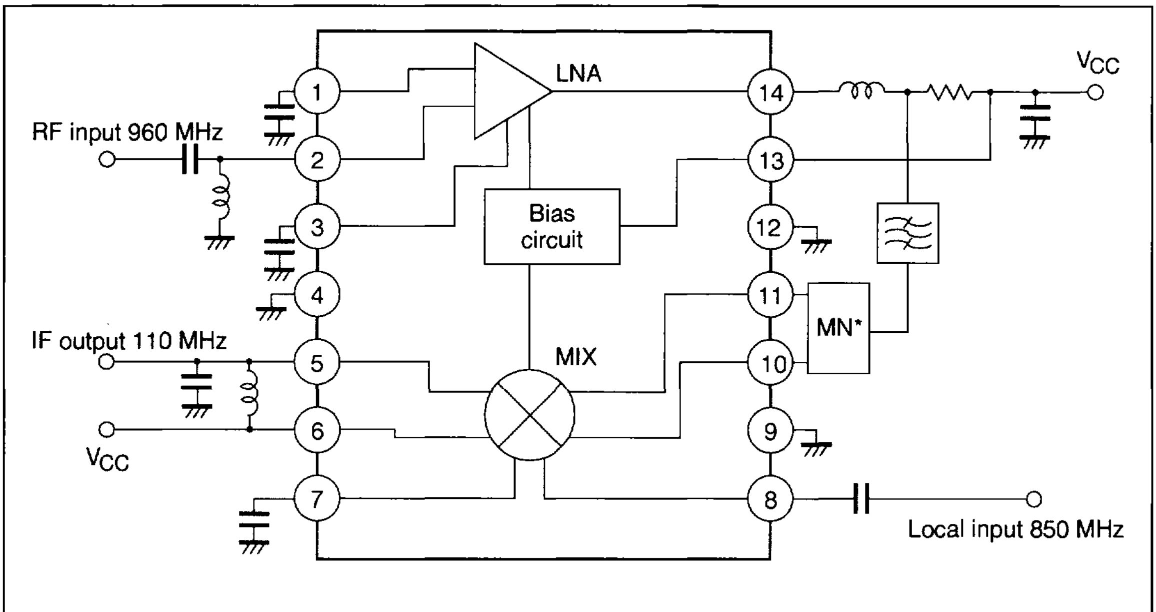
Features

- Low noise amplifier and double balanced mixer one-chip IC
- 5 V Operation
- Surface mount package
  : TSSOP-14 (TTP-14D)

Pin Arrangement



Block Diagram



*MN : Matching Network

Precautions
The GaAs IC could be damaged or destroyed if charged with high static electricity. Please have all equipments discharged before connecting the device.
This production contains GaAs, only a few GaAs are still very harm for human.
Don't decompose or process into powder or vapor.

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Supply voltage	V_{CC}*1	7	V
Maximum current	It	20	mA
Maximum input voltage	Vin*2	±2.5	V
Power dissipation	Pd*3	100	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C
Operation temperature	Topr	–30 to +85	°C

Notes: 1. Operation voltage is 4.5 to 5.5V.
2. Applied to 7, 8, 10, 11 pin.
3. When mounted on glass epoxy PCB (40 mm x 40 mm x 1.5 mm^t) covered with copper more than 30%. (Ta = 70 °C)

Electrical Characteristics (Ta = 25°C, V_{CC} = 5 V)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Quiescent current	I_Q	5	8	11	mA	No signal
LNA power gain	PG	8.5	12	—	dB	P_{RF} = –40 dBm
LNA noise figure	NF1	—	1.6	2.5	dB	
Mixer conversion gain	CG	9	12	—	dB	P_{RF} = –30 dBm
Mixer noise figure	NF2	—	8	10	dB	

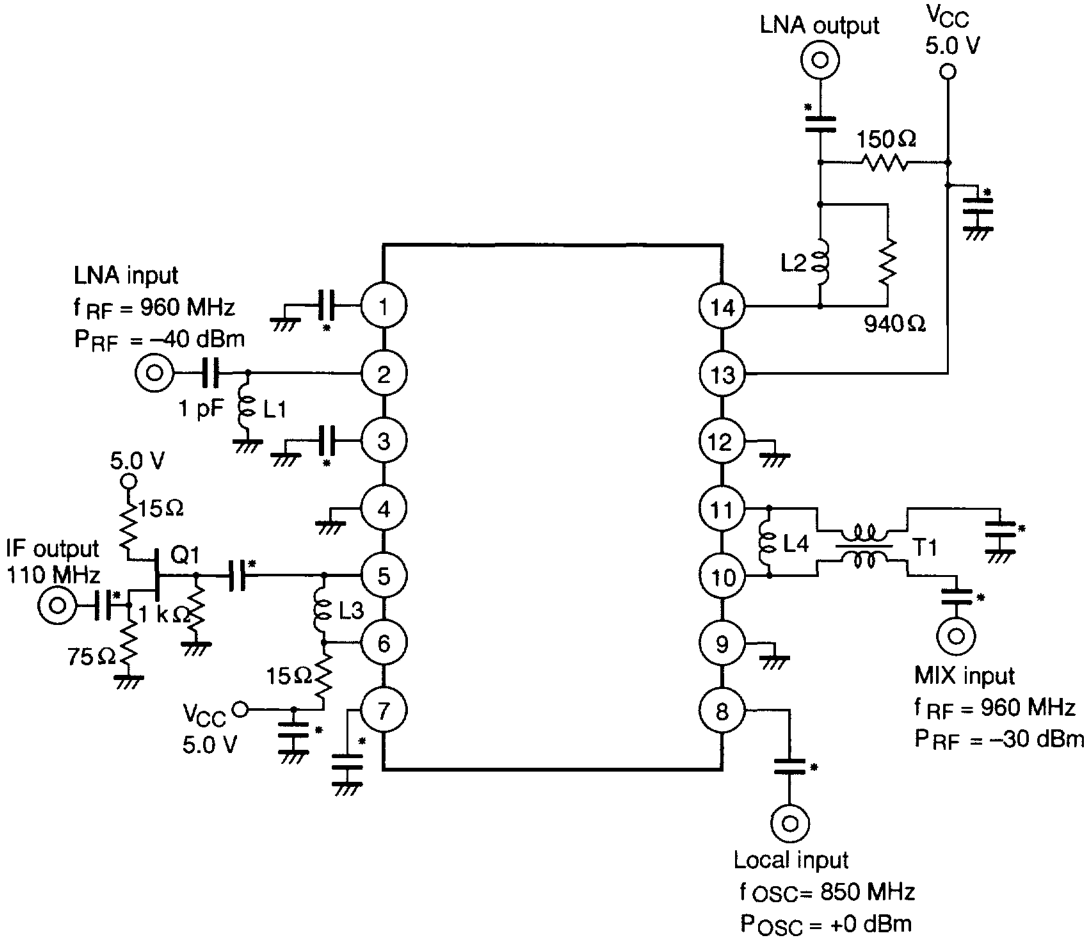
Notes: 1. All characteristics are measured with test fixture.
2. Test condition is as follows unless otherwise specified.
RF = 960 MHz, IF = 110 MHz, P_{LOCAL} = 0 dBm

Typical Performance (Ta = 25°C, V_{CC} = 5 V)

Item	Symbol	Typ	Unit	Test conditions
LNA power gain	PG	16	dB	–40 dBm 2 RF signal input
LNA noise figure	NF1	1.7	dB	
LNA 3rd order intermodulation distortion	$IM3_1$	65	dB	–40 dBm 2 RF signal input
LNA 2nd order intermodulation distortion	$IM2_1$	50	dB	–40 dBm 2 RF signal input
LNA 1dB compression level	$P1dB_1$	–10	dBm	
Mixer conversion gain	CG	10	dB	–30 dBm 2 RF signal input
Mixer noise figure	NF2	7	dB	
Mixer 3rd order intermodulation distortion	$IM3_2$	55	dB	–30 dBm 2 RF signal input
Mixer 2nd order intermodulation distortion	$IM2_2$	45	dB	–30 dBm 2 RF signal input
Mixer 1dB compression level	$P1dB_2$	–5	dBm	

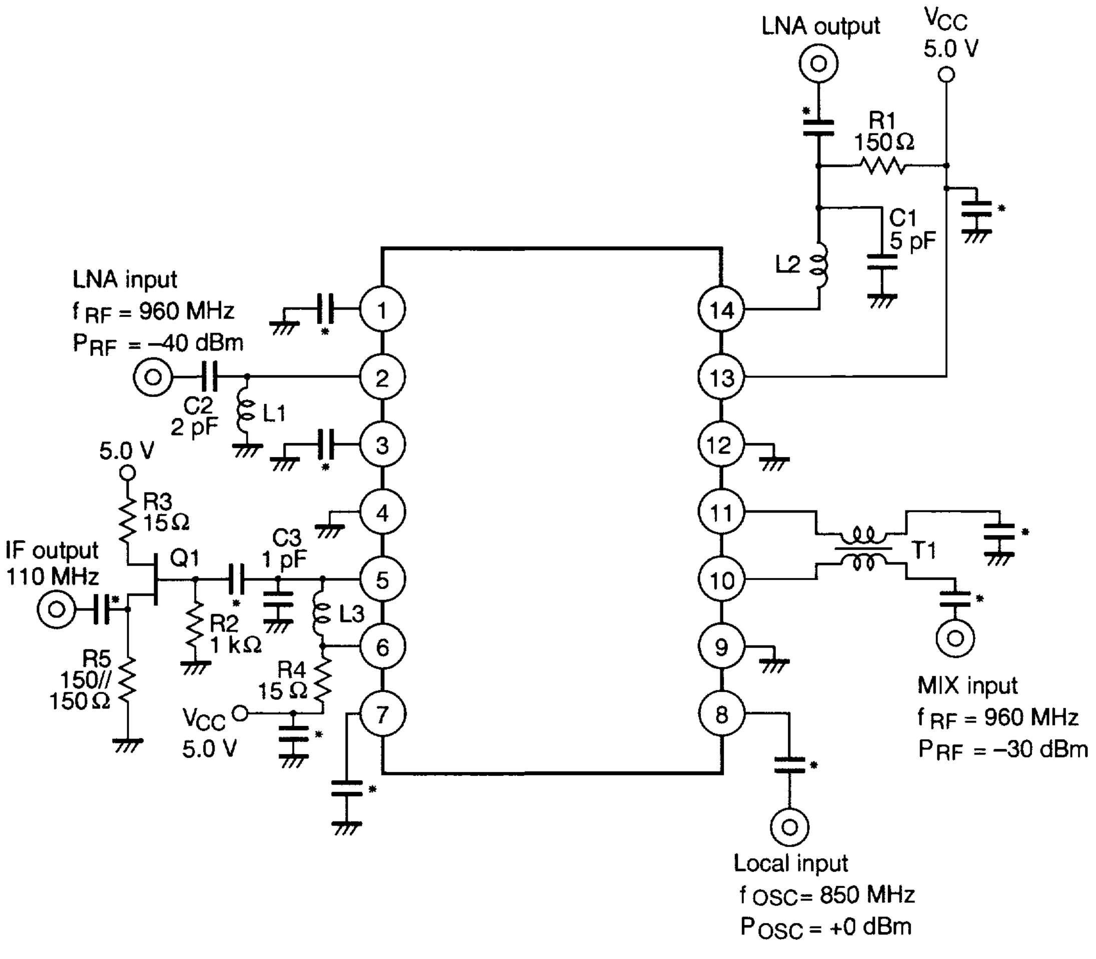
Notes: 1. All characteristics are measured with evaluation circuit.
2. Test condition is as follows unless otherwise specified.
RF = 960 MHz, IF = 110 MHz, P_{LOCAL} = 0 dBm

Test Fixture Circuit



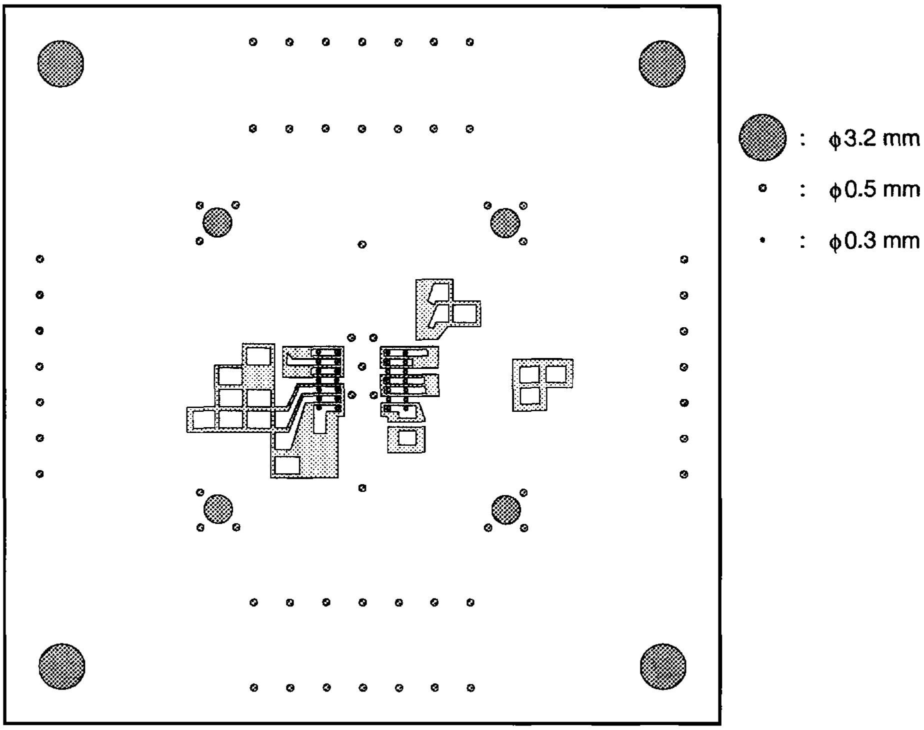
Q1 : 2SK668
T1 : 0.16 ϕ , pair wire, 4.5 Turn, using Outside dia 4 ϕ , Inside dia 2 ϕ , length 1.5 mm Ring core
L1 : 0.2 ϕ , 1.2 ϕ , 1.5 T
L2 : 10 nH (chip type)
L3 : 0.47 µH (chip type)
L4 : 0.2 ϕ , 1.1 ϕ , 5.5 T
* : 2200 pF

Evaluation Circuit

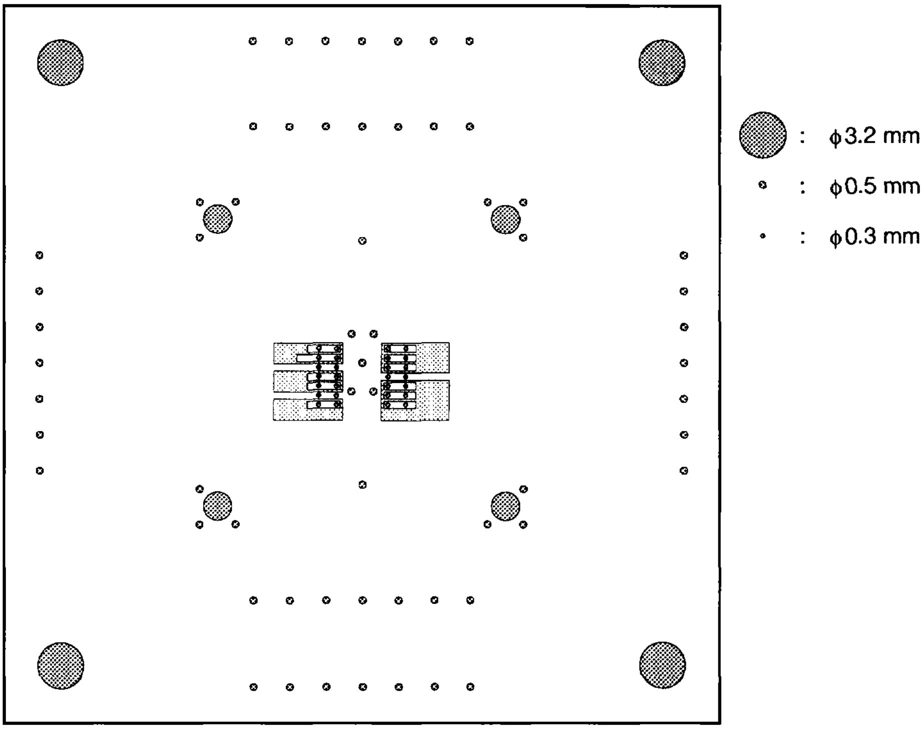


Q1 : 2SK668
T1 : 0.16 ϕ , pair wire, 2.5 Turn, using Outside dia 4 ϕ , Inside dia 2 ϕ , length 1.5 mm Ring core
L1 : 0.2 ϕ , 1.2 ϕ , 1.5 T
L2 : 0.2 ϕ , 1.2 ϕ , 4.5 T
L3 : 0.56 µH (chip type)
* : 2200 pF

PCB Pattern

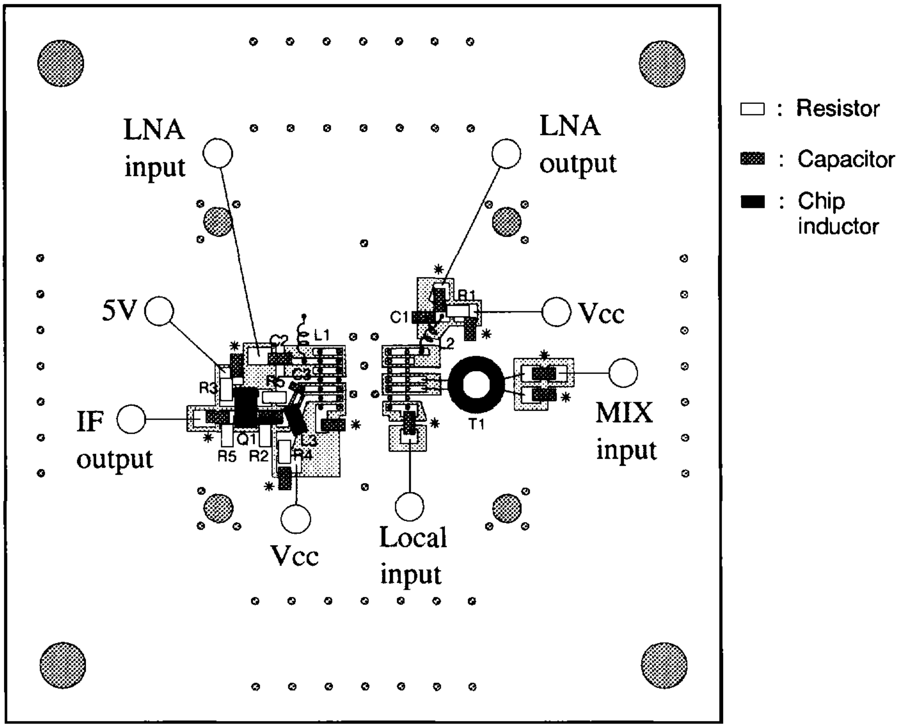


(Front Side View)

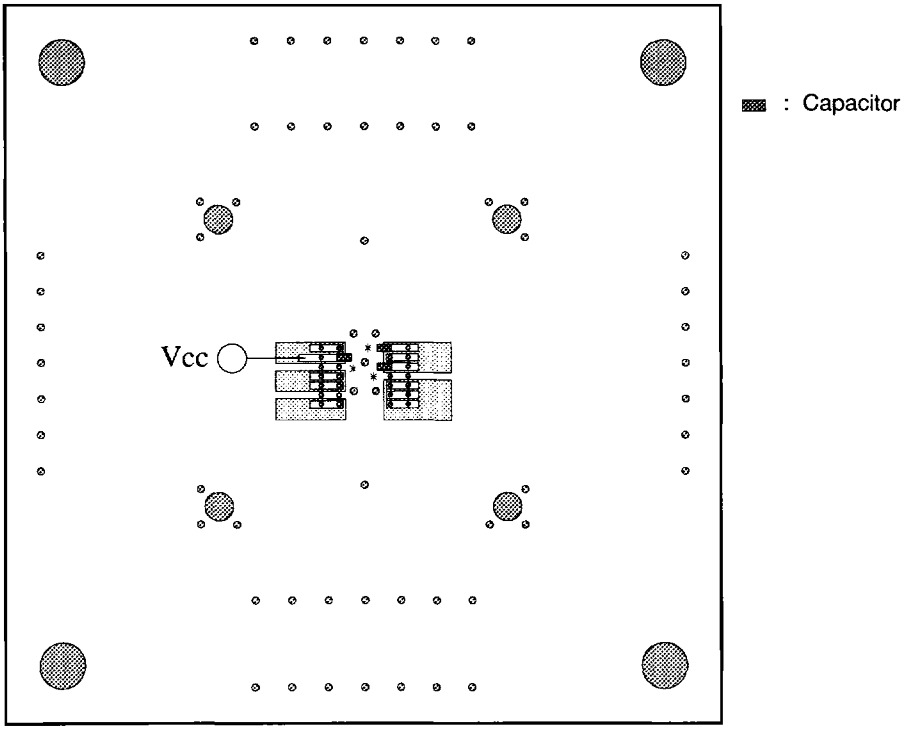


(Back Side View)

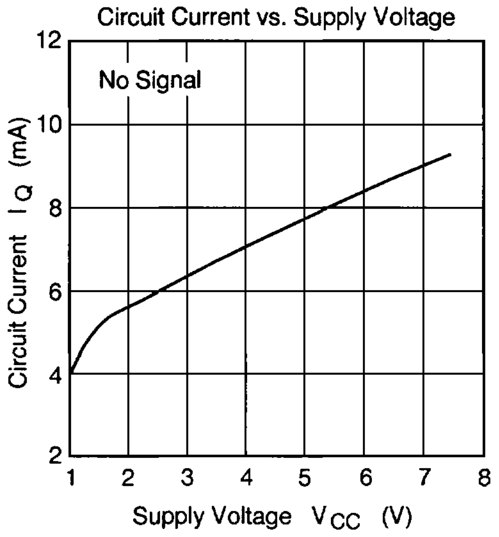
Parts Layout

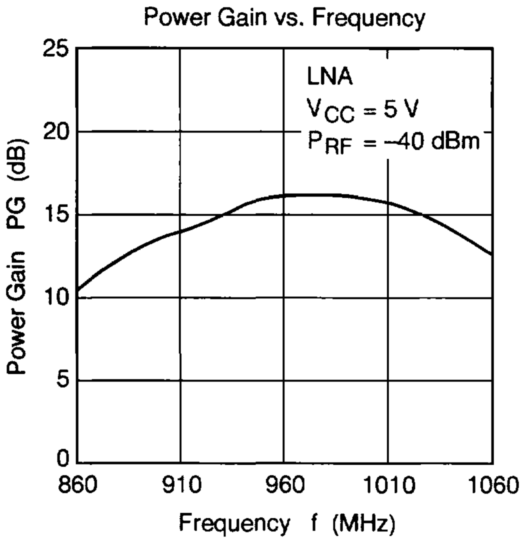


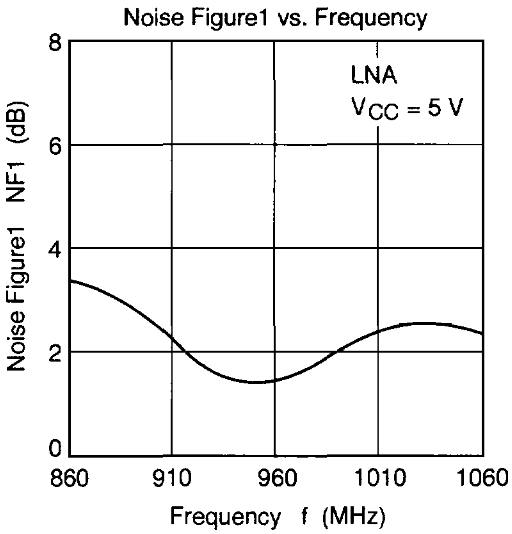
(Front Side View)

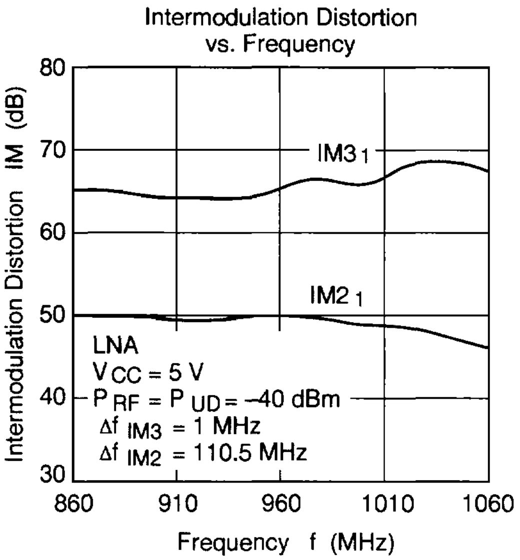


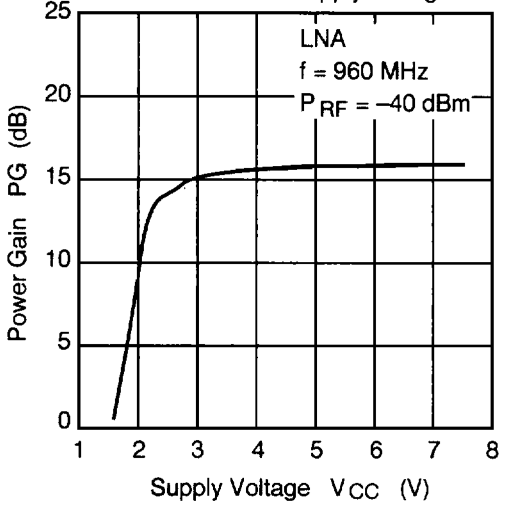
(Back Side View)

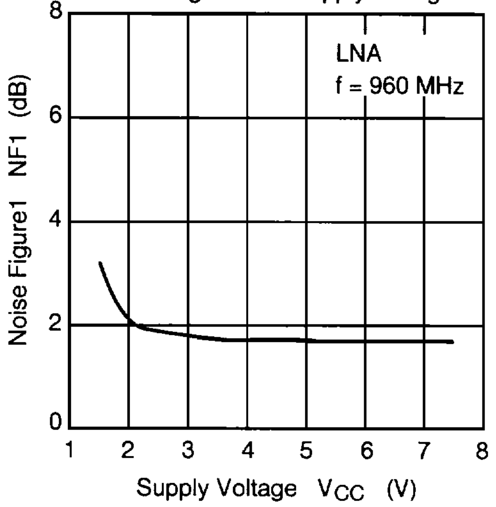

Circuit Current vs. Supply Voltage
No Signal
Circuit Current I_Q (mA)
12
10
8
6
4
2
1
2
3
4
5
6
7
8
Supply Voltage V_CC (V)

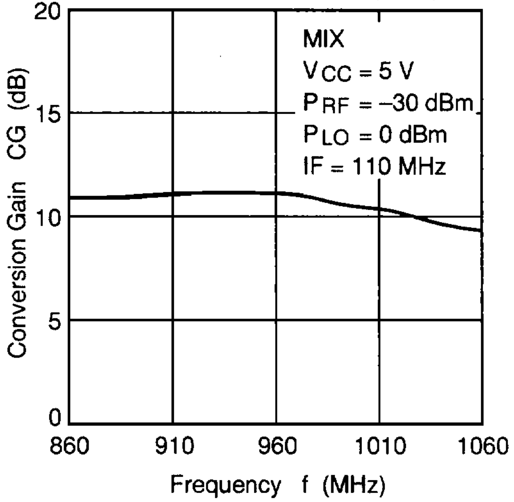

Power Gain vs. Frequency
LNA
V_CC = 5 V
P_RF = –40 dBm
Power Gain PG (dB)
25
20
15
10
5
0
860
910
960
1010
1060
Frequency f (MHz)

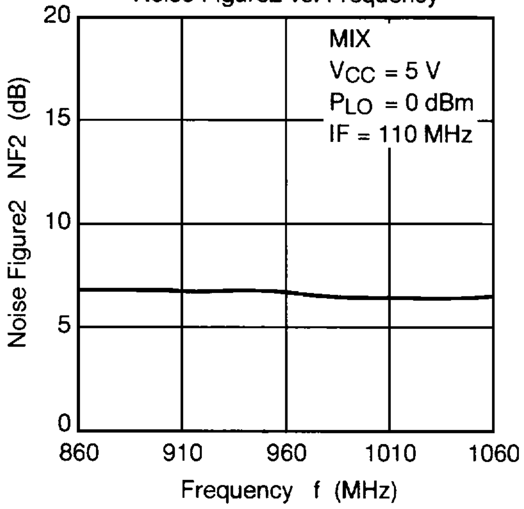

Noise Figure1 vs. Frequency
LNA
V_CC = 5 V
Noise Figure1 NF1 (dB)
8
6
4
2
0
860
910
960
1010
1060
Frequency f (MHz)

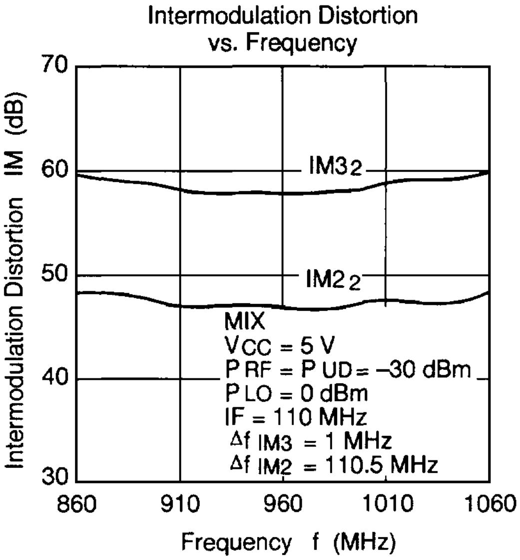

Intermodulation Distortion vs. Frequency
IM3 1
IM2 1
LNA
V_CC = 5 V
P_RF = P_UD = –40 dBm
Δf_IM3 = 1 MHz
Δf_IM2 = 110.5 MHz
Intermodulation Distortion IM (dB)
80
70
60
50
40
30
860
910
960
1010
1060
Frequency f (MHz)

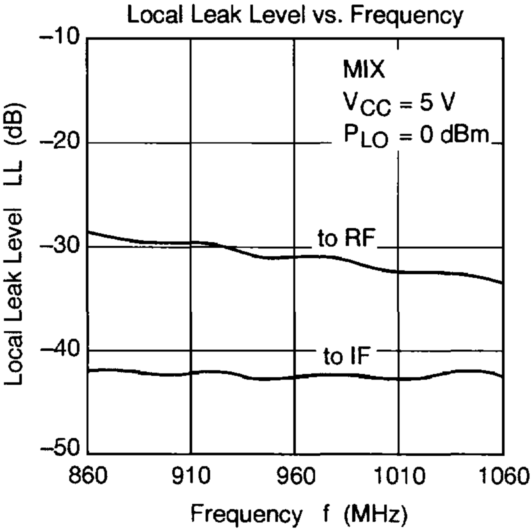

Power Gain vs. Supply Voltage

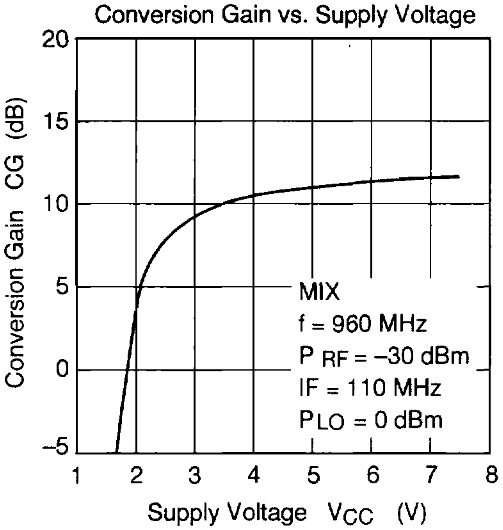

Noise Figure1 vs. Supply Voltage

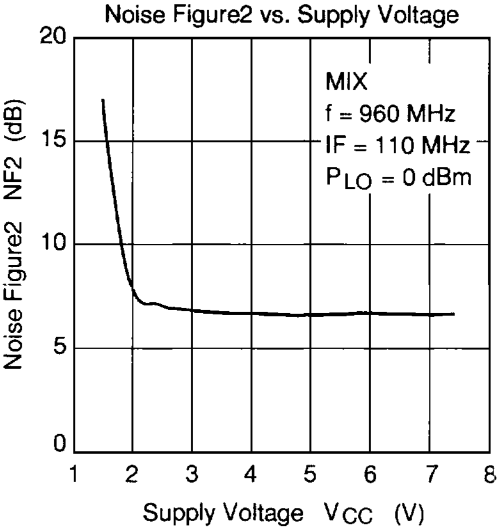

Conversion Gain vs. Frequency

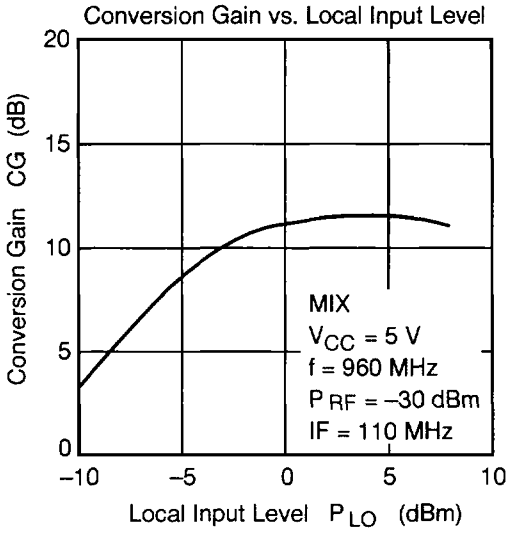

Noise Figure2 vs. Frequency

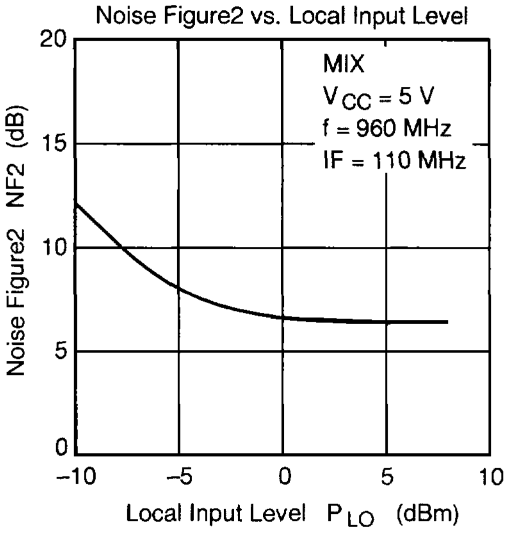

Intermodulation Distortion vs. Frequency
Intermodulation Distortion IM (dB)
70
60
50
40
30
IM3 2
IM2 2
MIX
V_{CC} = 5 V
P_{RF} = P_{UD} = –30 dBm
P_{LO} = 0 dBm
IF = 110 MHz
Δf_{IM3} = 1 MHz
Δf_{IM2} = 110.5 MHz
860
910
960
1010
1060
Frequency f (MHz)


Local Leak Level vs. Frequency
Local Leak Level LL (dB)
–10
–20
–30
–40
–50
MIX
V_{CC} = 5 V
P_{LO} = 0 dBm
to RF
to IF
860
910
960
1010
1060
Frequency f (MHz)


Conversion Gain vs. Supply Voltage
Conversion Gain CG (dB)
20
15
10
5
0
–5
MIX
f = 960 MHz
P_{RF} = –30 dBm
IF = 110 MHz
P_{LO} = 0 dBm
1
2
3
4
5
6
7
8
Supply Voltage V_{CC} (V)


Noise Figure2 vs. Supply Voltage
Noise Figure2 NF2 (dB)
20
15
10
5
0
MIX
f = 960 MHz
IF = 110 MHz
P_{LO} = 0 dBm
1
2
3
4
5
6
7
8
Supply Voltage V_{CC} (V)


Conversion Gain vs. Local Input Level


Noise Figure2 vs. Local Input Level