GaAs MIXER IC for 1.5 GHz ／1.9 GHz band

■ GENERAL DESCRIPTION

NJG1552F is a GaAs MMIC MIXER IC built-in local amplifier for 1.5 GHz／1.9GHz band Personal Digital Cellular／PHS.

It features a low power dissipation, a high conversion gain and a low noise figure.

In addition to be adopted a small package, a outer parts operating to it decreases.

■ PACKAGE OUTLINE

NJG1552F

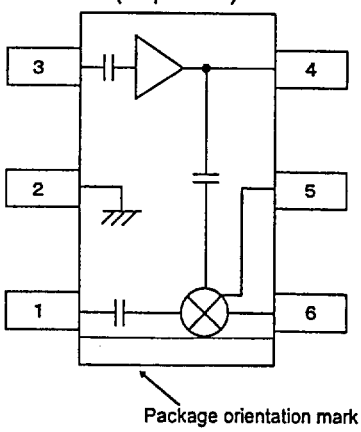
■ FEATURES

●Single and low supply voltage operation	+2.7V
●Low current consumption	4.5 mA Typ.
●High conversion gain	8dB Typ.@f_{RF}=1489MHz、P_{LO}=-10dBm、P_{RF}=-30dBm
	5dB Typ.@f_{RF}=1900MHz、P_{LO}=-10dBm、P_{RF}=-30dBm
●Low noise figure	6dB Typ.@f_{RF}=1489MHz、P_{LO}=-10dBm、P_{RF}=-30dBm
	6dB Typ.@f_{RF}=1900MHz、P_{LO}=-10dBm、P_{RF}=-30dBm
●Small package	MTP6

■ PIN CONFIGURATION

F TYPE

(Top View)



Pin Connection

1.RFIN
2.GND
3.LOIN
4.VLO
5.BPC
6.IFOUT

■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYNBOL	CONDITION	RATINGS	UNIT
SUPPLY VOLTAGE 1	V_{DD1}	T_a=25℃	5	V
SUPPLY VOLTAGE 2	V_{DD2}	T_a=25℃	5	V
Mixer RF Input Power	P_{RFIN}	T_a=25℃	10	dBm
Mixer LO Input Power	P_{LOIN}	T_a=25℃	10	dBm
Power Dissipation	P_D	T_a=25℃	150	mW
Operating Temperature	T_{opr}		-30～+85	℃
Storage Temperature	T_{stg}		-40～+150	℃

■ RECOMMMENDED OPERATING RANGE

PARAMETER	SYNBOL	MIN	TYP	MAX	UNIT
Supply Voltage in Mixer	V_{MIX}	2.5	2.7	4.5	V
Supply Voltage in Local Amplifier	V_{LO}	2.5	2.7	4.5	V

■ ELECTRICAL CHARACTERISTICS 〔 DC CHARACTERISTICS 〕

(T_a=25℃、V_{MIX}=2.7V、V_{LO}=2.7V)

PARAMETER	SYNBOL	CONDITION	MIN	TYP	MAX	UNIT
Mixer Current	I_{MIX}	P_{RF}=OFF , P_{LO}=OFF	—	3.0	4.5	mA
Local Amplifier Current	I_{LO}	P_{RF}=OFF , P_{LO}=OFF	—	1.5	2.3	mA

■ ELECTRICAL CHARACTERISTICS [AC CHARACTERISTICS of 1.5 GHz band]

(T_a=25℃、V_{MIX}=2.7V、V_{LO}=2.7V、f_{IF}=130MHz、P_{LO}=-10dBm)

PARAMETER	SYNBOL	CONDITION	MIN	TYP	MAX	UNIT
Conversion Gain	G_{C1}	f_{RF}=1489MHz , P_{RF}=-30dBm f_{LO}=1619MHz	5.0	8.0	—	dB
Input 3'rd Order Intercept Point	IIP3_1	f_{RF}=1489.0MHz+1489.1MHz f_{LO}=1619MHz	—	-5.0	—	dBm
Noise Figure	NF1	f_{RF}=1489MHz , P_{RF}=-30dBm f_{LO}=1619MHz	—	6.0	7.5	dB

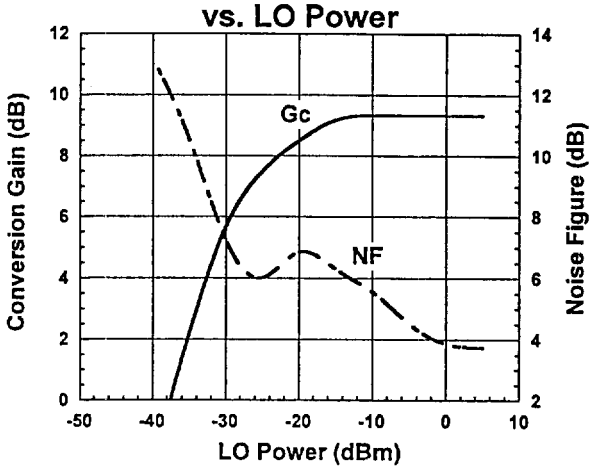
■ ELECTRICAL CHARACTERISTCS [AC CHARACTERISTICS of 1.9 GHz band]

(T_a=25℃、V_{MIX}=2.7V、V_{LO}=2.7V、f_{IF}=240MHz、P_{LO}=-10dBm)

PARAMETER	SYNBOL	CONDITION	MIN	TYP	MAX	UNIT
Conversion Gain	G_{C2}	f_{RF}=1900MHz , P_{RF}=-30dBm f_{LO}=1660MHz	3.0	5.0	—	dB
Input 3'rd Order Intercept Point	IIP3_2	f_{RF}=1900.0MHz+1900.1MHz f_{LO}=1660MHz	—	1.0	—	dBm
Noise Figure	NF2	f_{RF}=1900MHz , P_{RF}=-30dBm f_{LO}=1660MHz	—	6.0	7.5	dB

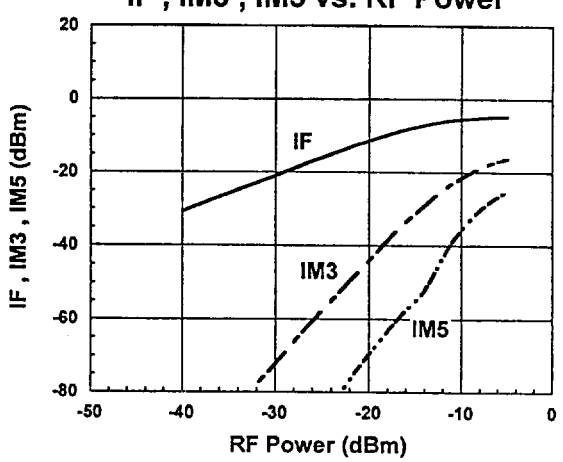
■ TYPICAL CHARACTERISTICS (1.5GHz band)

Conversion Gain , Noise Figure vs. LO Power



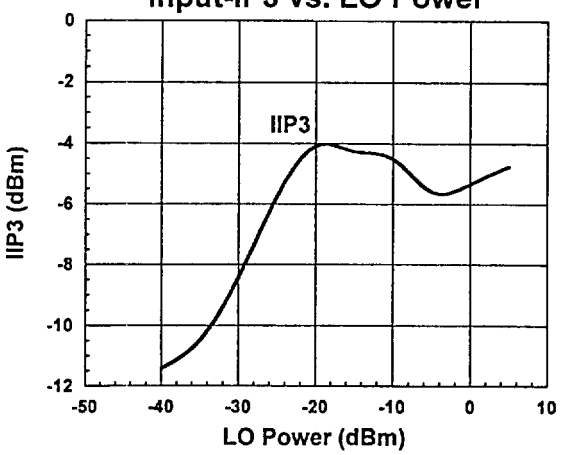
Condition
f_{IF}=130MHz
f_{RF}=1489MHz,P_{RF}=-30dBm
f_{LO}=1619MHz
V_{MIX}=V_{LO}=2.7V

IF , IM3 , IM5 vs. RF Power



Condition
f_{IF}=130MHz
f_{RF1}=1489.0MHz
f_{RF2}=1489.1MHz
f_{LO}=1619MHz,P_{LO}=-10dBm
V_{MIX}=V_{LO}=2.7V

Input-IP3 vs. LO Power

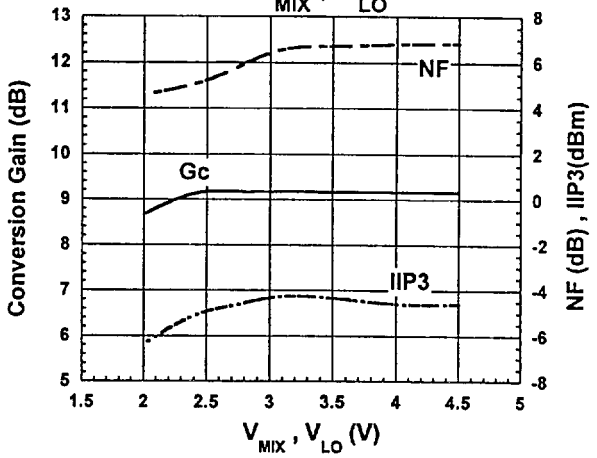


Condition
f_{IF}=130MHz
f_{RF1}=1489.0MHz,P_{RF}=-30dBm
f_{RF2}=1489.1MHz
f_{LO}=1619MHz
V_{MIX}=V_{LO}=2.7V

$$IIP3=\frac{3IF-IM3}{2}-G_c$$

@P_{RF}=-30dBm

Conversion Gain , Noise Figure , Input-IP3 vs. V_{MIX} , V_{LO}



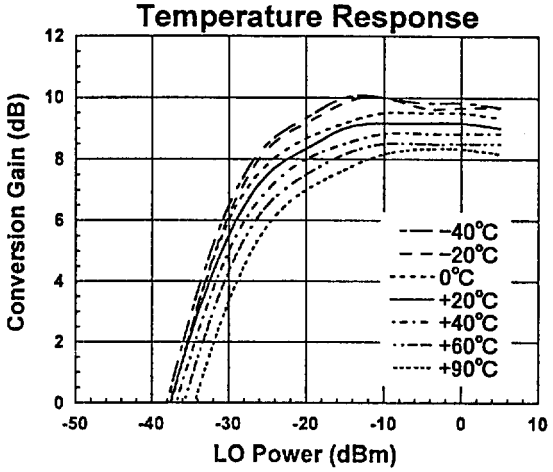
Condition
f_{IF}=130MHz
f_{RF1}=1489.0MHz,P_{RF}=-30dBm
f_{RF2}=1489.1MHz
f_{LO}=1619MHz,P_{LO}=-10dBm

$$IIP3=\frac{3IF-IM3}{2}-G_c$$

@P_{RF}=-30dBm

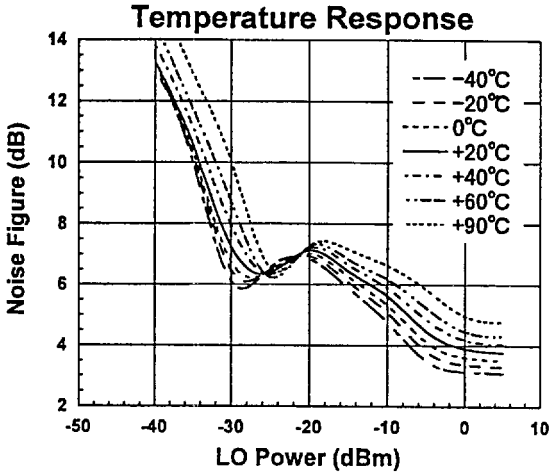
■ TYPICAL CHARACTERISTICS (1.5GHz band)

Conversion Gain vs. LO Power Temperature Response



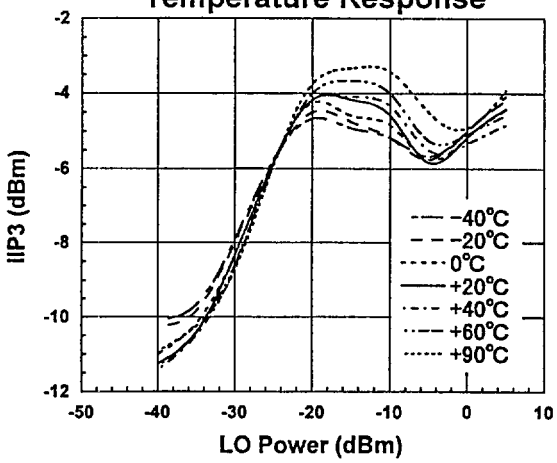
Condition
f_{IF}=130MHz
f_{RF}=1489MHz,P_{RF}=-30dBm
f_{LO}=1619MHz
V_{MIX}=V_{LO}=2.7V

Noise Figure vs. LO Power Temperature Response



Condition
f_{IF}=130MHz
f_{RF}=1489MHz
f_{LO}=1619MHz
V_{MIX}=V_{LO}=2.7V

Input-IP3 vs. LO Power Temperature Response

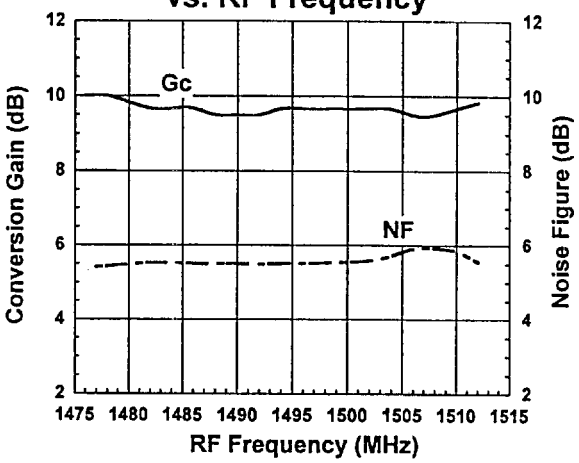


Condition
f_{IF}=130MHz
f_{RF1}=1489.0MHz,P_{RF}=-30dBm
f_{RF2}=1489.1MHz
f_{LO}=1619MHz
V_{MIX}=V_{LO}=2.7V

$$IIP3=\frac{3IF-IM3}{2}-G_c$$

@P_{RF}=-30dBm

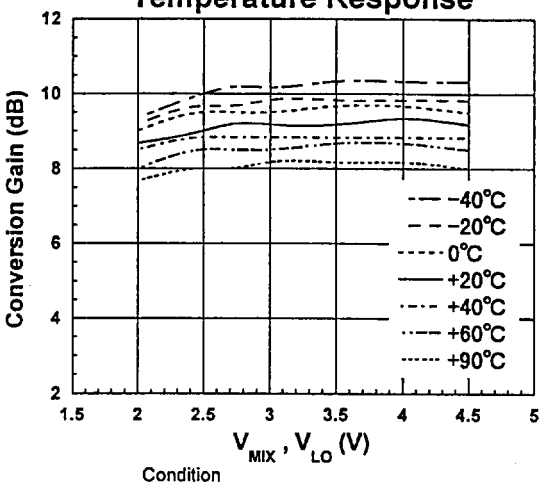
Conversion Gain , Noise Figure vs. RF Frequency



Condition
f_{IF}=130MHz
P_{RF}=-30dBm
P_{LO}=-10dBm
V_{MIX}=V_{LO}=2.7V

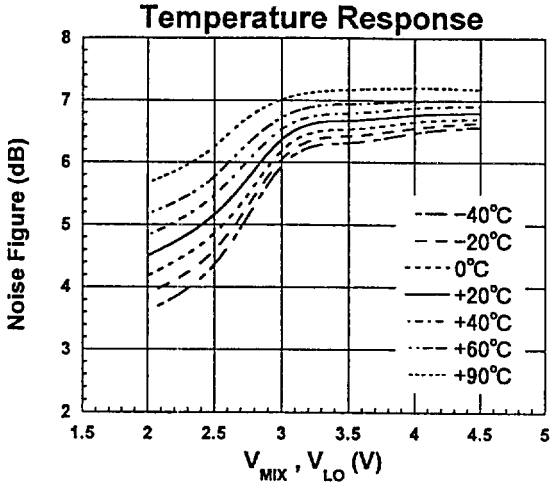
■ TYPICAL CHARACTERISTICS (1.5GHz band)

Conversion Gain vs. V_{MIX} , V_{LO} Temperature Response



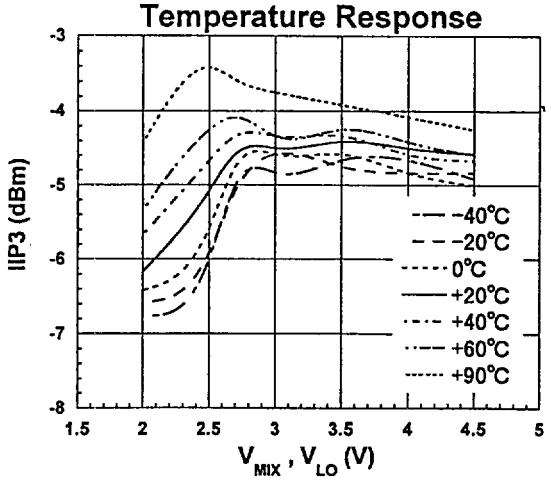
Condition
f_{IF}=130MHz
f_{RF}=1489MHz,P_{RF}=-30dBm
f_{LO}=1619MHz,P_{LO}=-10dBm

Noise Figure vs. V_{MIX} , V_{LO} Temperature Response



Condition
f_{IF}=130MHz
f_{RF}=1489MHz
f_{LO}=1619MHz,P_{LO}=-10dBm

Input-IP3 vs. V_{MIX} , V_{LO} Temperature Response

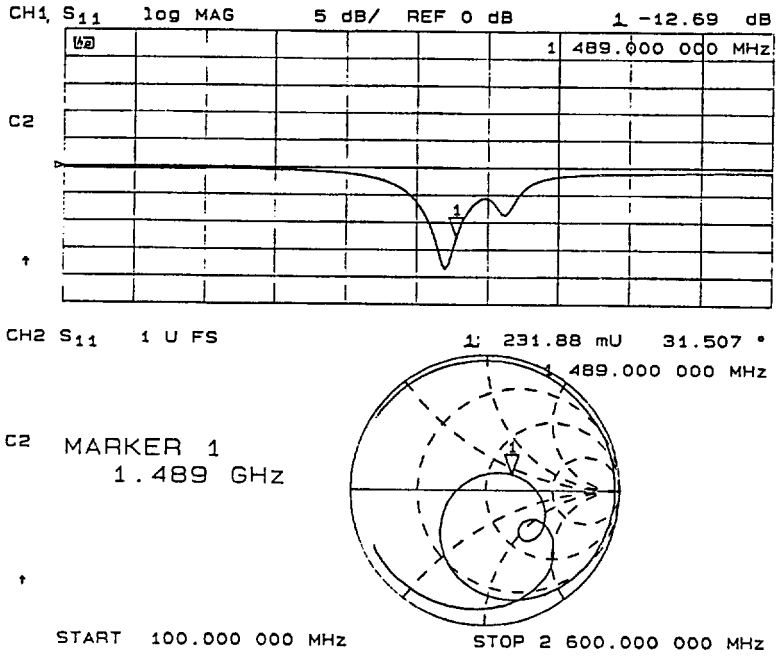


Condition
f_{IF}=130MHz
f_{RF1}=1489.0MHz,P_{RF}=-30dBm
f_{RF2}=1489.1MHz
f_{LO}=1619MHz,f_{LO}=-10dBm

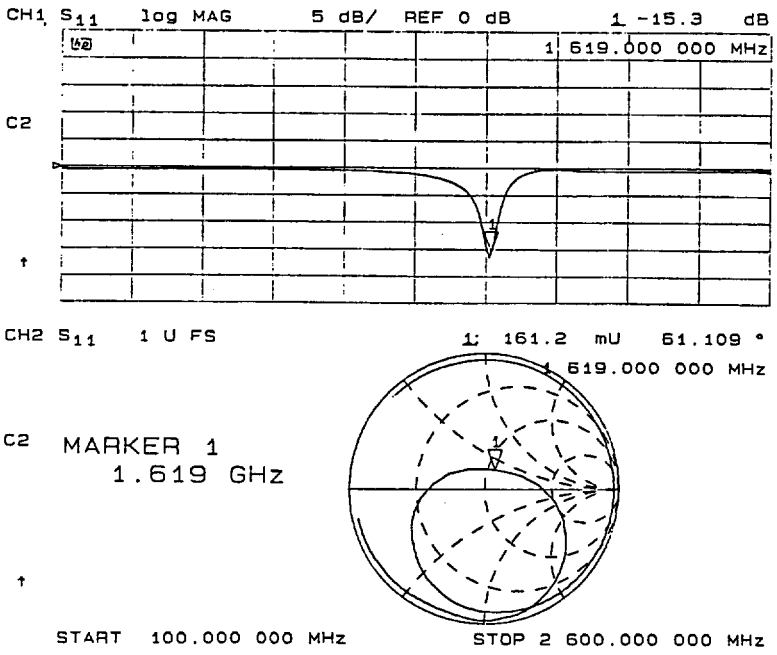
$$IIP3=\frac{3IF-IM3}{2}-G_c$$

@P_{RF}=-30dBm

■ TYPICAL CHARACTERISTICS (1.5GHz band)

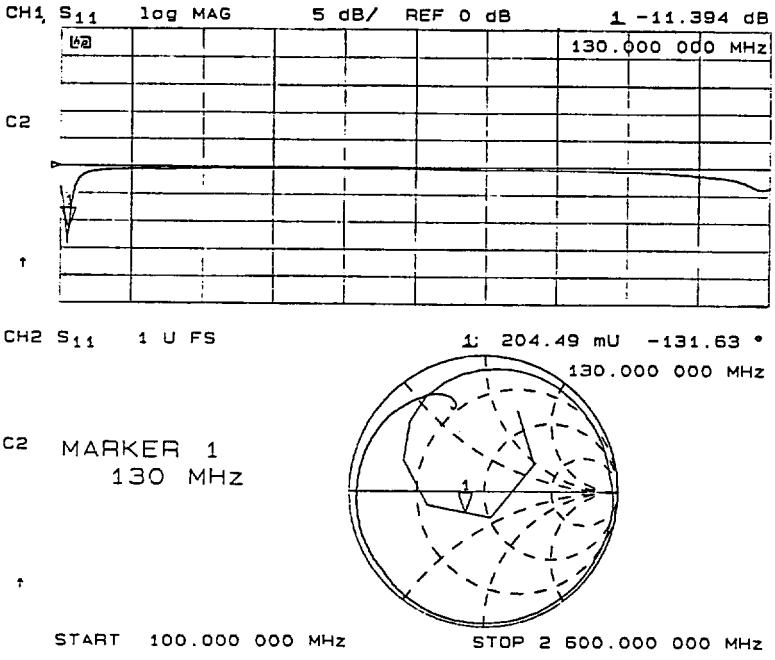


RFIN PORT EXTERNAL MATCHING NETWORK IMPEDANCE PLOT



LOIN PORT EXTERNAL MATCHING NETWORK IMPEDANCE PLOT

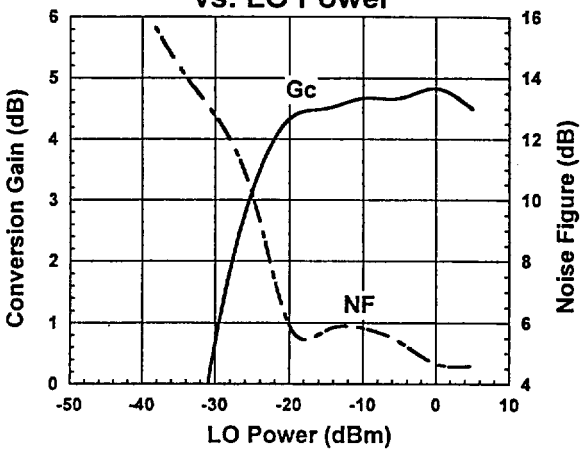
TYPICAL CHARACTERISTICS (1.5GHz band)



IFOUT PORT EXTERNAL MATCHING NETWORK IMPEDANCE PLOT

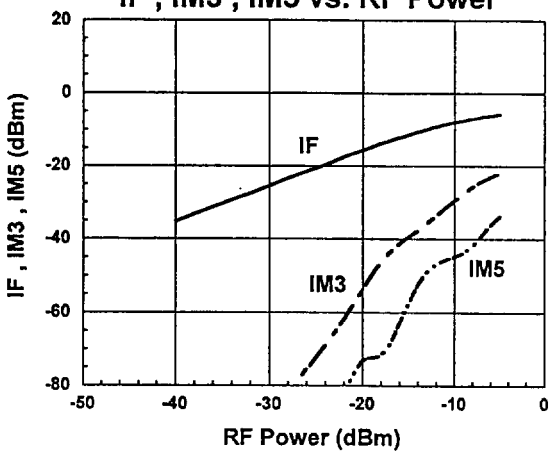
■ TYPICAL CHARACTERISTICS (1.9GHz band)

Conversion Gain , Noise Figure vs. LO Power



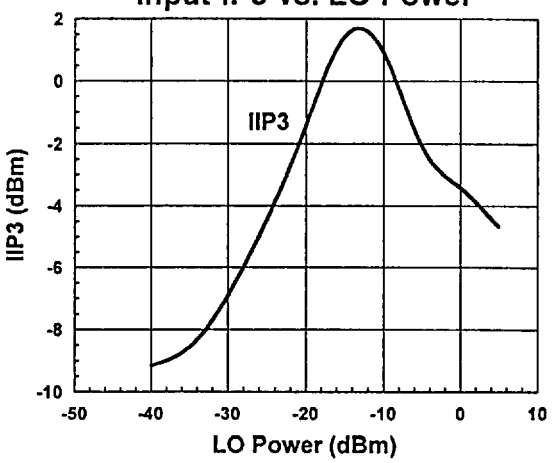
Condition
f_{IF}=240MHz
f_{RF}=1900MHz,P_{RF}=-30dBm
f_{LO}=1660MHz
V_{MIX}=V_{LO}=2.7V

IF , IM3 , IM5 vs. RF Power



Condition
f_{IF}=240MHz
f_{RF1}=1900.0MHz
f_{RF2}=1900.1MHz
f_{LO}=1660MHz,P_{LO}=-10dBm
V_{MIX}=V_{LO}=2.7V

Input-IP3 vs. LO Power

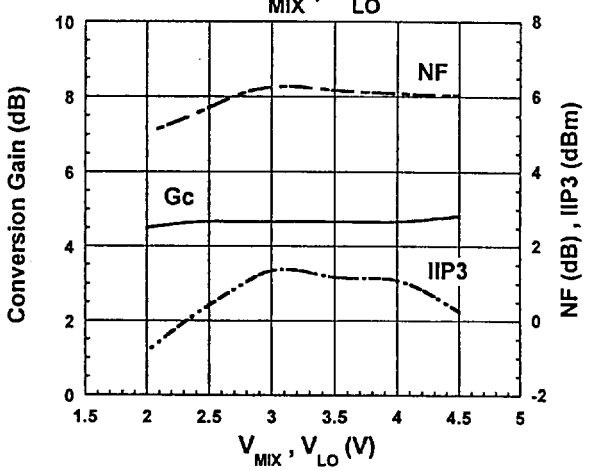


Condition
f_{IF}=240MHz
f_{RF1}=1900.0MHz,P_{RF}=-25dBm
f_{RF2}=1900.1MHz
f_{LO}=1660MHz
V_{MIX}=V_{LO}=2.7V

$$IIP3=\frac{3IF-IM3}{2}-G_c$$

@P_{RF}=-25dBm

Conversion Gain , Noise Figure , Input-IP3 vs. V_{MIX} , V_{LO}



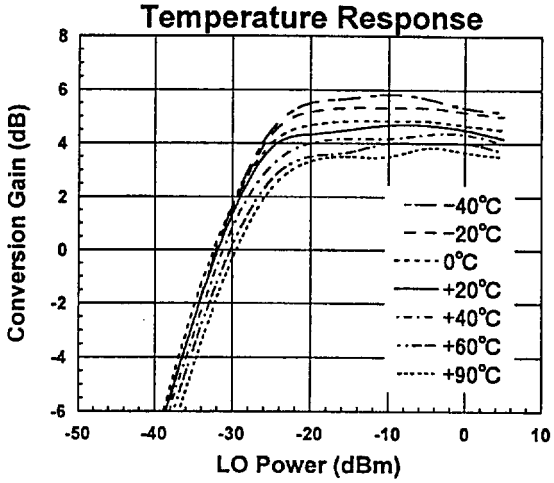
Condition
f_{IF}=240MHz
f_{RF1}=1900.0MHz,P_{RF}=-30dBm
f_{RF2}=1900.1MHz
f_{LO}=1660MHz,P_{LO}=-10dBm

$$IIP3=\frac{3IF-IM3}{2}-G_c$$

@P_{RF}=-25dBm

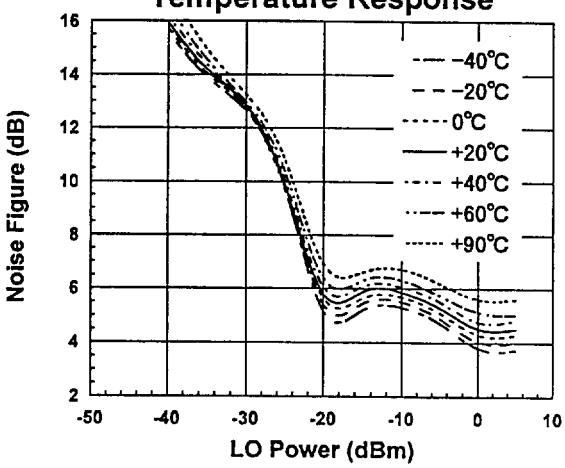
TYPICAL CHARACTERISTICS (1.9GHz band)

Conversion Gain vs. LO Power Temperature Response



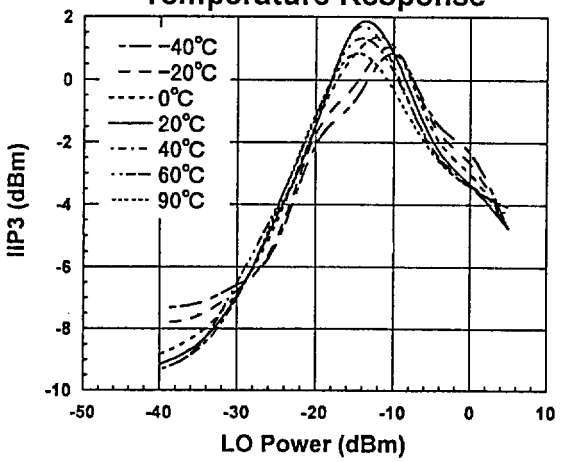
Condition
f_{IF}=240MHz
f_{RF}=1900MHz,P_{RF}=-30dBm
f_{LO}=1660MHz
V_{MIX}=V_{LO}=2.7V

Noise Figure vs. LO Power Temperature Response



Condition
f_{IF}=240MHz
f_{RF}=1900MHz
f_{LO}=1660MHz
V_{MIX}=V_{LO}=2.7V

Input-IP3 vs. LO Power Temperature Response

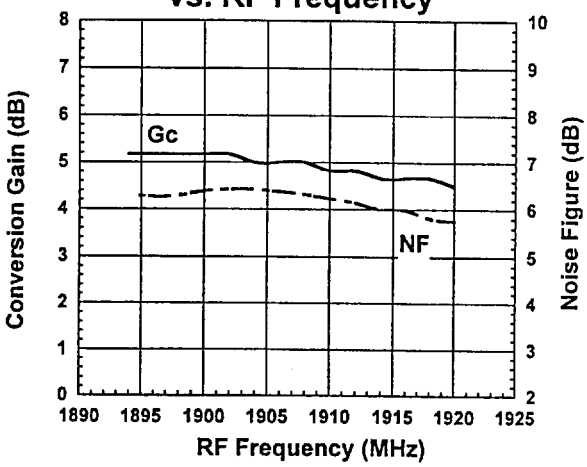


Condition
f_{IF}=240MHz
f_{RF1}=1900.0MHz,P_{RF}=-25dBm
f_{RF2}=1900.1MHz
f_{LO}=1660MHz
V_{MIX}=V_{LO}=2.7V

$$IIP3=\frac{3IF-IM3}{2}-G_c$$

@P_{RF}=-25dBm

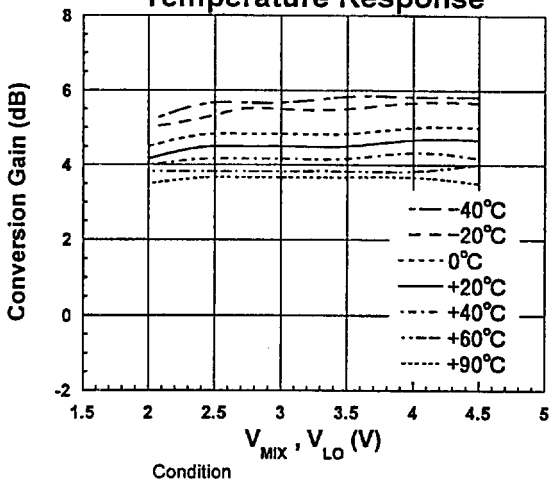
Conversion Gain , Noise Figure vs. RF Frequency



Condition
f_{IF}=240MHz
P_{RF}=-30dBm
P_{LO}=-10dBm
V_{MIX}=V_{LO}=2.7V

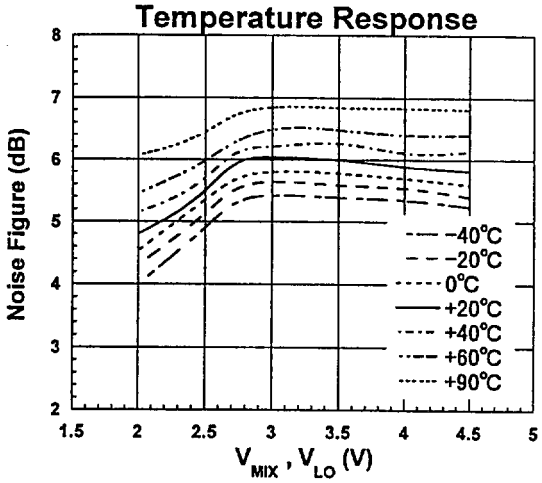
■ TYPICAL CHARACTERISTICS (1.9GHz band)

Conversion Gain vs. V_{MIX} , V_{LO} Temperature Response



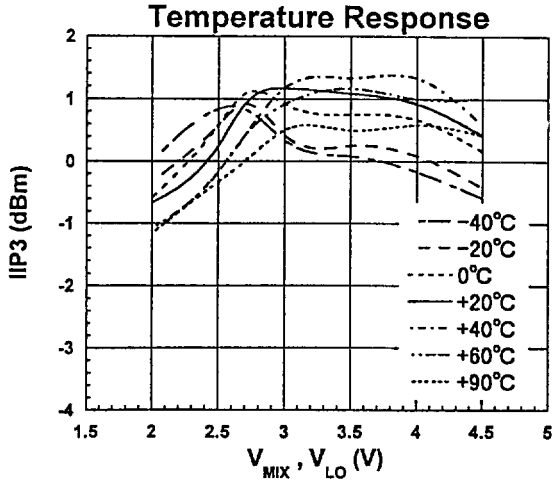
Condition
f_{IF}=240MHz
f_{RF}=1900MHz,P_{RF}=-30dBm
f_{LO}=1660MHz,P_{LO}=-10dBm

Noise Figure vs. V_{MIX} , V_{LO} Temperature Response



Condition
f_{IF}=240MHz
f_{RF}=1900MHz
f_{LO}=1660MHz,P_{LO}=-10dBm

Input-IP3 vs. V_{MIX} , V_{LO} Temperature Response

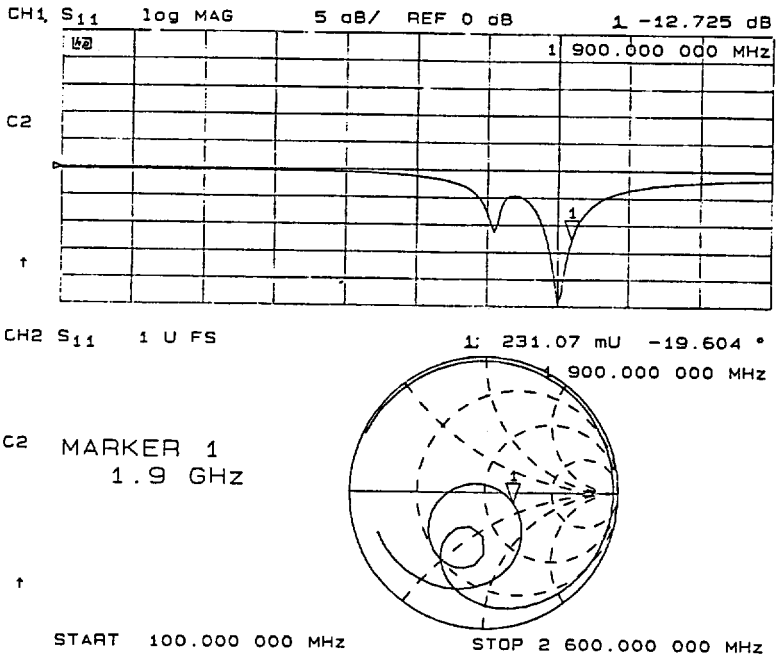


Condition
f_{IF}=240MHz
f_{RF1}=1900.0MHz,P_{RF}=-25dBm
f_{RF2}=1900.1MHz
f_{LO}=1660MHz,f_{LO}=-10dBm

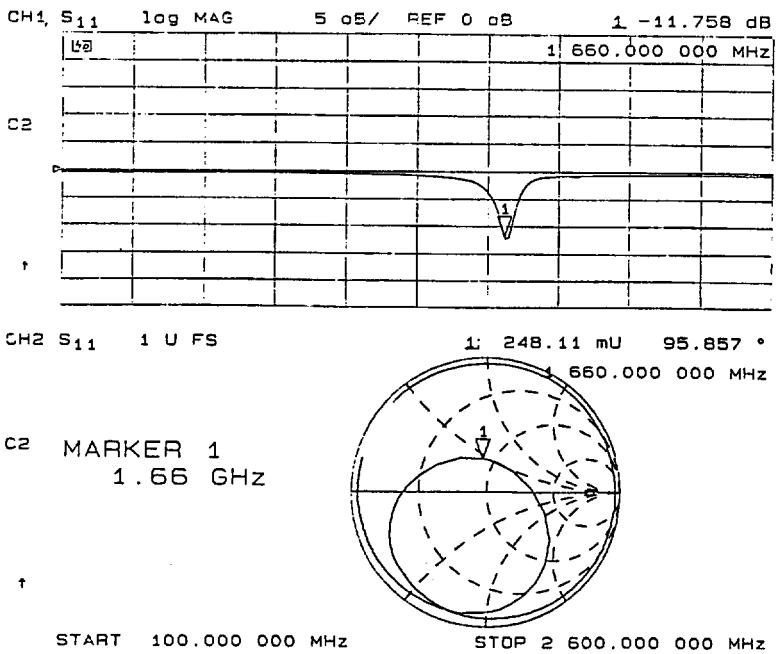
$$IIP3=\frac{3IF-IM3}{2}-G_c$$

@P_{RF}=-25dBm

■ TYPICAL CHARACTERISTICS (1.9GHz band)

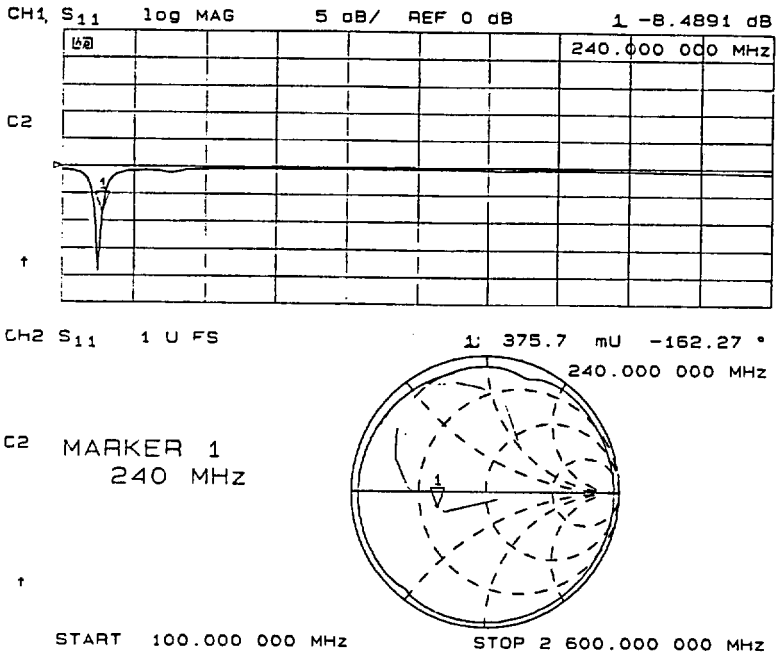


RFIN PORT EXTERNAL MATCHING NETWORK IMPEDANCE PLOT



LOIN PORT EXTERNAL MATCHING NETWORK IMPEDANCE PLOT

■ TYPICAL CHARACTERISTICS (1.9GHz band)



IFOUT PORT EXTERNAL MATCHING NETWORK IMPEDANCE PLOT

■ DOWN CONVERTER APPLICATION CIRCUIT

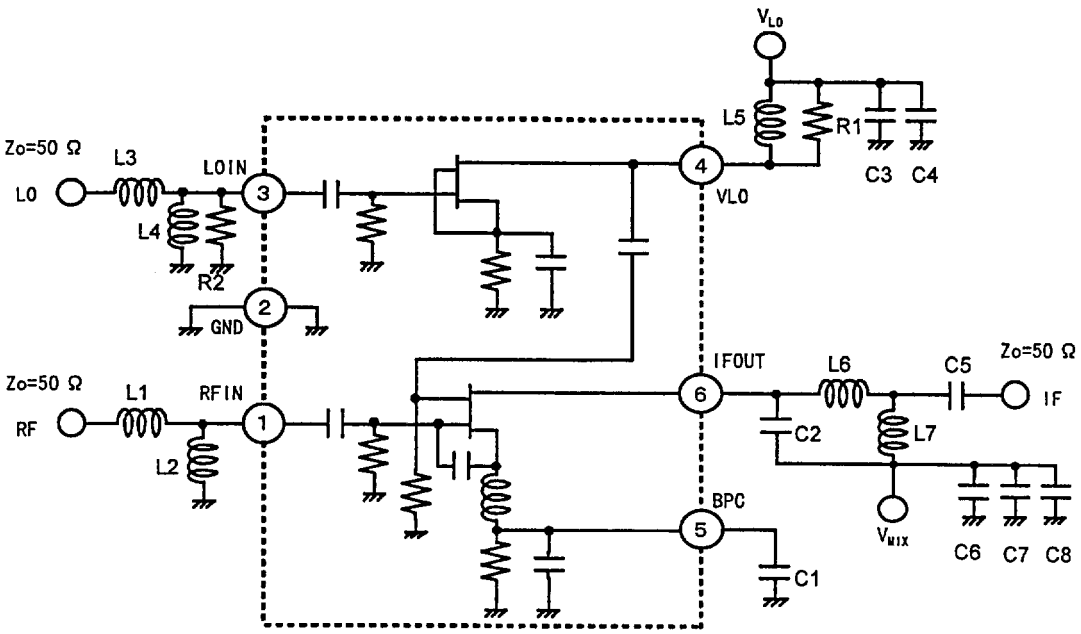
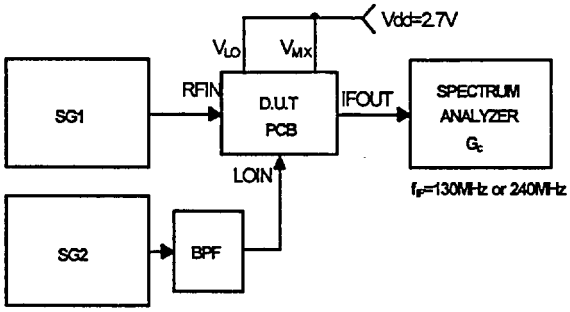


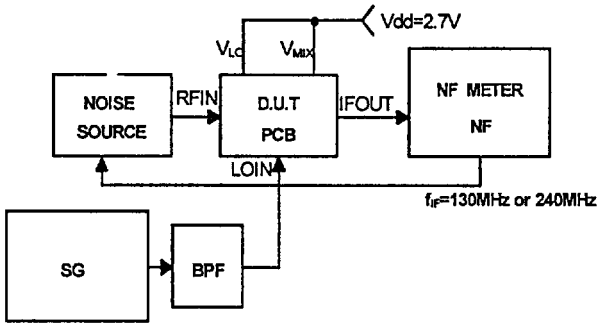
Table The Parts using the above circuit

PART ID	1.5GHz band Upper LOCAL f_{LO}=1619MHz	1.9GHz band Lower LOCAL f_{LO}=1660MHz	COMMENT
L1	10nH	6.8nH	TAIYO-YUDEN HK1608 series
L2	8.2nH	4.7nH	〃
L3	15nH	15nH	〃
L4	12nH	10nH	〃
L5	5.6nH	4.7nH	〃
L6	100nH	39nH	〃
L7	56nH	18nH	〃
C1	1000pF	560pF	MURATA GRM39 series
C2	11pF	8pF	〃
C3	100pF	100pF	〃
C4	1000pF	1000pF	〃
C5	1000pF	1000pF	〃
C6	10pF	10pF	〃
C7	100pF	100pF	〃
C8	1000pF	1000pF	〃
R1	430 Ω	390 Ω	TAMA ElectronicsCRG16Gseries
R2	1k Ω	1k Ω	〃

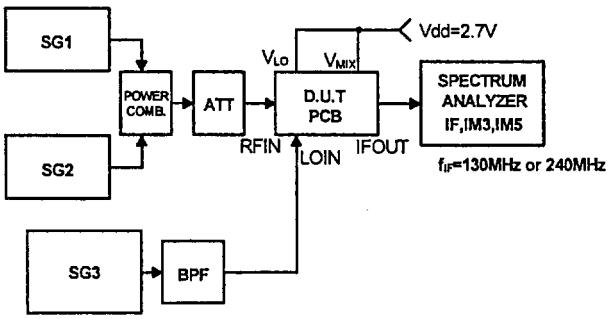
■ MEASURING BLOCK DIAGRAM



Conversion Gain Measuring Block Diagram



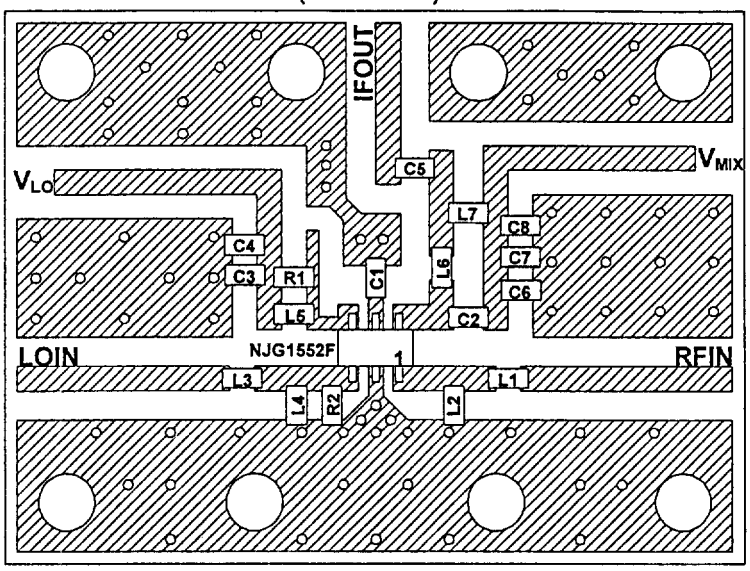
Noise Figure Measuring Block Diagram



IF , IM3 , IM5 Measuring Block Diagram

■ RECOMMENDED PCB DESIGN

(TOP VIEW)



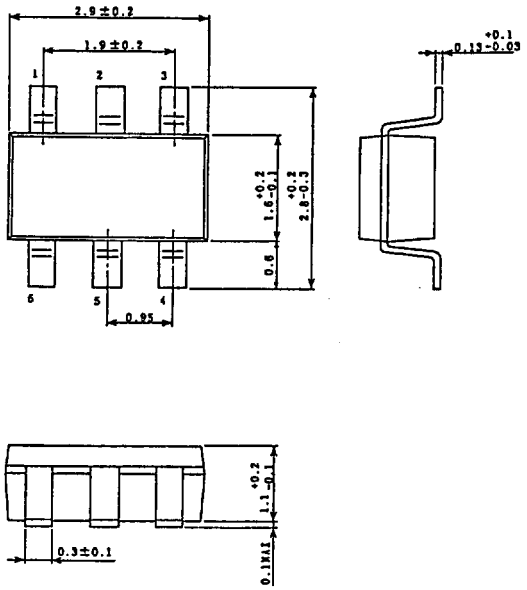
(PCB SIZE :22.5mm x 30mm)

PCB : FR-4
t=0.5mm
STRIP LINE WIDTH=1mm

Caution on using devices

[1] Please connect the L1 to the place being about 3.5mm from RF frequency input terminal(RFIN).
[2] Please connect the L3 to the place being about 3.5mm from local input terminal (LOIN).
[3] Please connect the C1 to the place being near by-pass capacitor terminal(BPC).
[4] Please set the C6,C7,C8 near C2
[5] Please set the C3,C4 near R1 or L5.

■ PACKAGE OUTLINE



PACKAGE TYPE : MTP6
UNIT : mm

Caution on using the products

A GaAs is used in this products. A GaAs is a harmful material.

- Don't eat or in the mouth.
- Don't dispose in fire or break up the products.
- Don't make a gas or a powdered with the chemical reaction.
- In the case of wasting the products, please obey the relation rule in the each country.

This product may be broken with static electric discharge or serge voltage. Therefore, please note a handing.

The other caution item

- The product specifications and descriptions listed in this catalog are subject to change at any time, without notice.
- It is to modify the details of this catalog without making any preliminary announcement.
- We don't take upon ourselves the responsibilities that infringe on other people's rights of a patents bringing about the information and drawing in this catalog.
- It is not purpose to be equipped with the system needs a high reliability as air system, submarine cable system, atomic energy control system and medical instrument for keeping life.
  If you think the above system, please ask for the sales office beforehand.
- In the case of coming under the technology or the freights regulated the based on foreign exchange and the Foreign Exchange Control Law, a export of this products may agree with the same law.