1.5GHz/1.9GHz MIXER GaAs MMIC

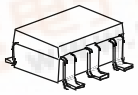
■GENERAL DESCRIPTION

NJG1552F is a mixer GaAs MMIC featured low power consumption, high conversion gain and low noise figure.

This mixer includes a local amplifier, and ideally suitable for 1.5/1.9Hz band digital mobile phone and PHS handsets.

The very small MTP package is adopted.

■PACKAGE OUTLINE



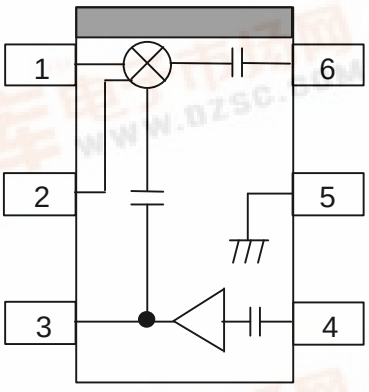
NJG1552F

■FEATURES

●Low voltage operation	+2.7V
●Low current consumption	4.5mA typ.
●High conversion gain	8dB typ. @f_{RF}=1.489GHz, P_{LO}=-10dBm, P_{RF}=-30dBm
	5dB typ. @f_{RF}=1.9GHz, P_{LO}=-10dBm, P_{RF}=-30dBm
●Low noise figure	6dB typ. @f_{RF}=1.489GHz, P_{LO}=-10dBm
	9dB typ. @f_{RF}=1.9GHz, P_{LO}=-10dBm
●Package	MTP6 (Mount Size: 2.8x2.9x1.2mm)

■PIN CONFIGURATION

F Type
(Top View)



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

■ABSOLUTE MAXIMUM RATINGS

(T_a=25°C, Z_s=Z_l=50Ω)

PARAMETERS	SYMBOL	CONDITIONS	RATINGS	UNITS
Mixer Supply Voltage	V_{MIX}		5	V
Local Amplifier Supply Voltage	V_{LO}		5	V
Mixer RF Input Power	P_{RFIN}	V_{MIX}=2.7V, V_{LO}=2.7V	10	dBm
Mixer LO Input Power	P_{LOIN}	V_{MIX}=2.7V, V_{LO}=2.7V	10	dBm
Power Dissipation	P_D		150	mW
Operating Temp.	T_{opr}		-30~+85	°C
Storage Tempe.	T_{stg}		-40~+150	°C

■RECOMMENDED OPERATING RANGE

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Mixer Supply Voltage	V_{MIX}	2.5	2.7	4.5	V
Local Amplifier Supply Voltage	V_{LO}	2.5	2.7	4.5	V

■ELECTRICAL CHARACTERISTICS (DC)

(T_a=25°C, V_{MIX}=2.7V, V_{LO}=2.7V)

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
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 (RF 1.5GHz band)

(T_a=25°C, V_{MIX}=2.7V, V_{LO}=2.7V, f_{IF}=130MHz, P_{LO}=-10dBm, Application1.5GHz, f_{LO}=1619MHz)

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Conversion Gain	G_C1	f_{RF}=1489MHz, P_{RF}=-30dBm	5.0	8.0	-	dB
3rd Order Intercept Point	IIP3-1	f_{RF}=1489.0MHz+1489.1MHz	-	-5.0	-	dBm
Noise Figure	NF1	f_{RF}=1489.0MHz	-	6.0	8.0	dB

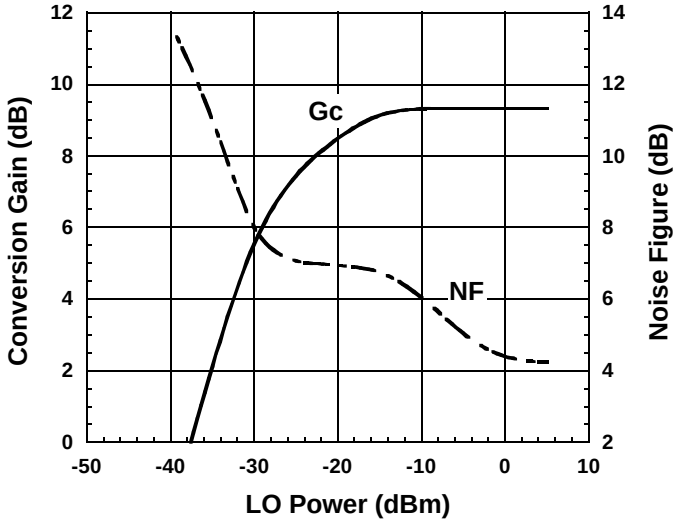
■ELECTRICAL CHARACTERISTICS (RF 1.9GHz band)

(T_a=25°C, V_{MIX}=2.7V, V_{LO}=2.7V, f_{IF}=240MHz, P_{LO}=-10dBm, Application1.9GHz, f_{LO}=1660MHz)

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Conversion Gain	G_C2	f_{RF}=1900MHz, P_{RF}=-30dBm	3.0	5.0	-	dB
3rd Order Intercept Point	IIP3-2	f_{RF}=1900.0MHz+1900.1MHz	-	1.0	-	dBm
Noise Figure	NF2	f_{RF}=1900.0MHz	-	9.0	11.0	dB

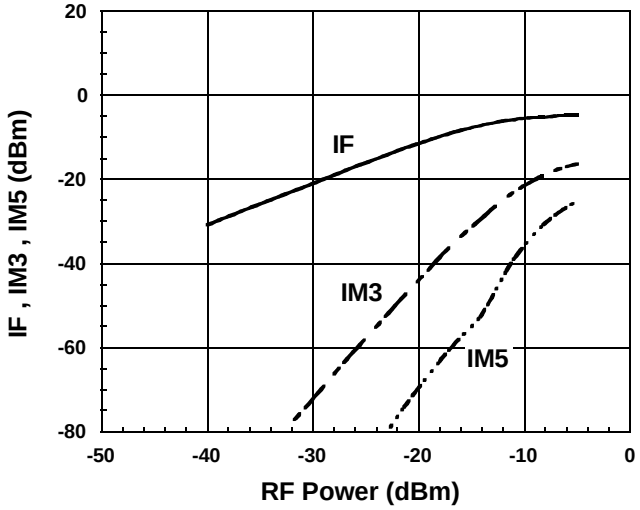
■**TYPICAL CHARACTERISTICS** (Application 1, f=1.5GHz, f_{LO}=1619MHz)

Conversion Gain , Noise Figure vs. LO Power



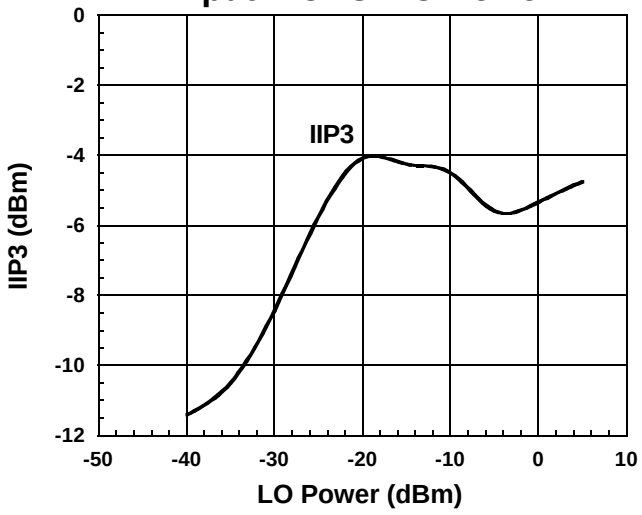
Condition
f_{IF}=130MHz
f_{RF}=1489MHz, P_{RF}=-30dBm
f_{LO}=1619MHz
V_{MIX}=V_{LO}=2.7V

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

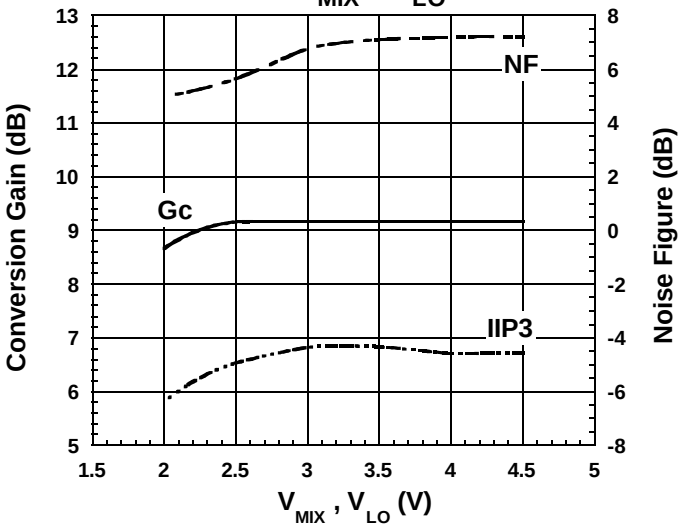
Input-IP3 vs. LO Power



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

$$IIP3=\frac{3IF\text{-}IM3}{2}-G_c$$
@P_{RF}=-30dBm

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

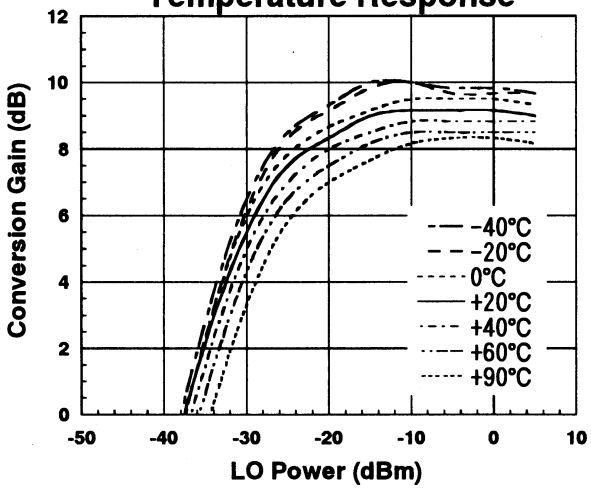


Condition
f_{IF}=130MHz
f_{RF1}=1489.0MHz, P_{RF}=-30dBm
f_{RF2}=1489.1MHz
f_{LO}=1619MHz, P_{LO}=-10dBm

$$IIP3=\frac{3IF\text{-}IM3}{2}-G_c$$
@P_{RF}=-30dBm

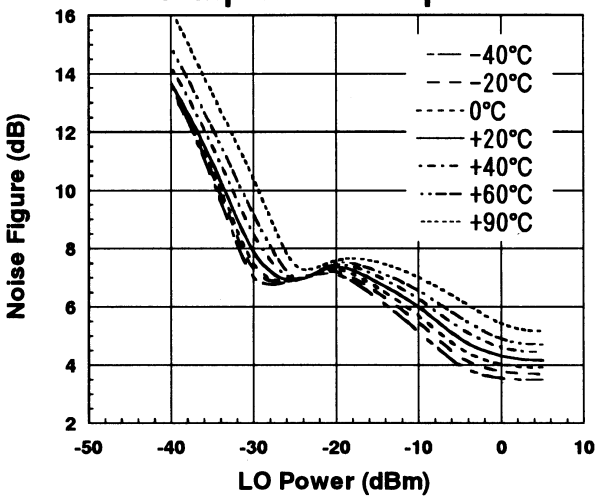
■TYPICAL CHARACTERISTICS (Continued)

Conversion Gain vs. LO Power Temperature Response



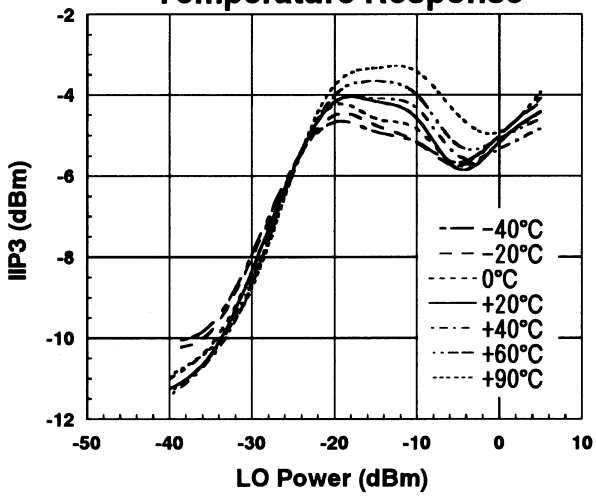
Condition
f_{IF}=130MHz
f_{RF}=1489MHz, P_{RF}=-30dBm
f_{LO}=1619MHz
V_{MIX}=V_{LO}=2.7V

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

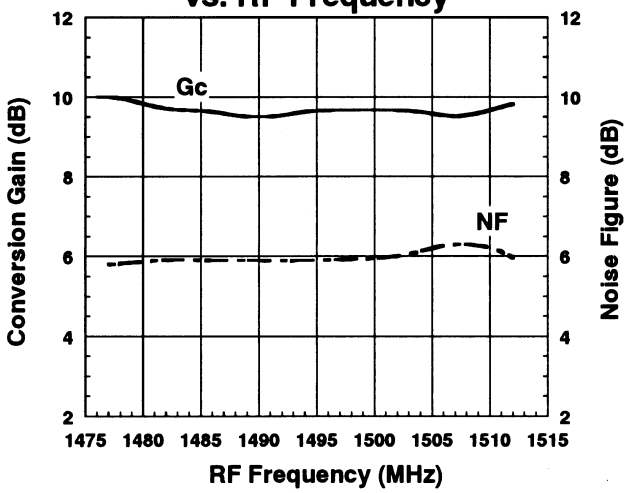


Condition
f_{IF}=130MHz
f_{RF1}=1489.0MHz, P_{RF}=-30dBm
f_{RF2}=1489.1MHz
f_{LO}=1619MHz
V_{MIX}=V_{LO}=2.7V

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

@P_{RF}=-30dBm

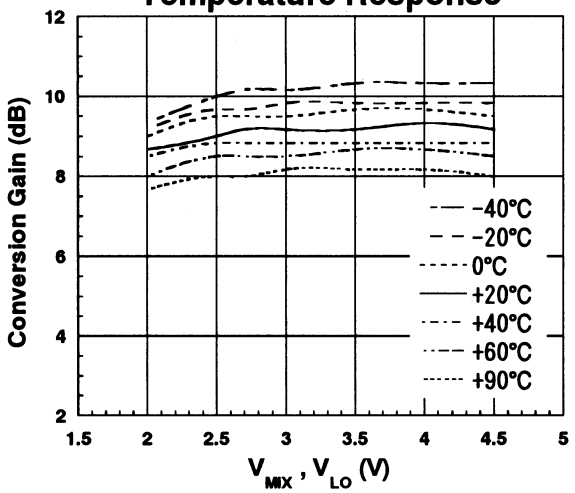
Conversion Gain , Noise Figure vs. RF Frequency



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

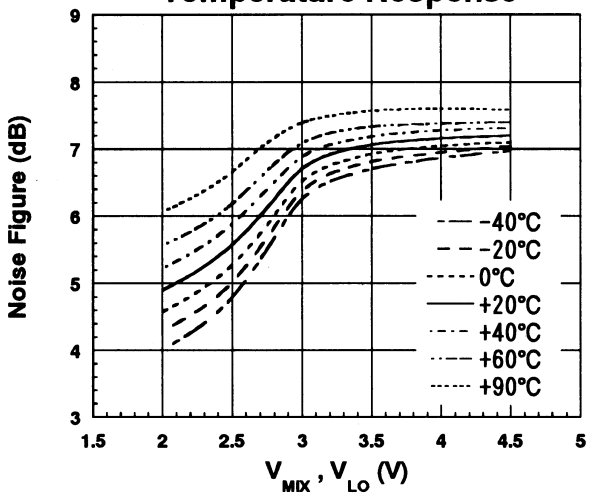
■TYPICAL CHARACTERISTICS (Continued)

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



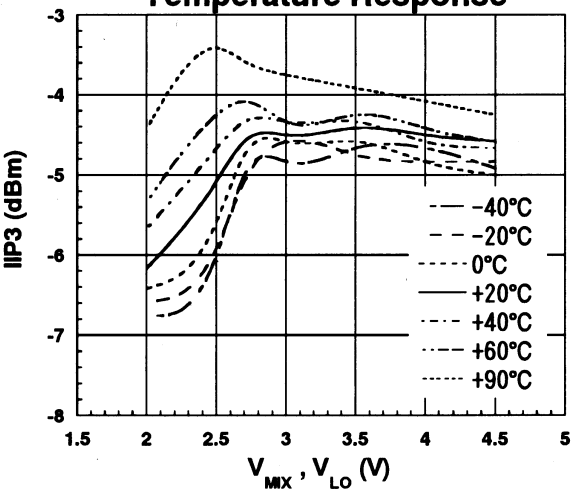
Condition
f_{IF}=130MHz
f_{RF}=1489MHz, P_{RF}=-30dBm
f_{LO}=1619MHz, P_{LO}=-10dBm

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

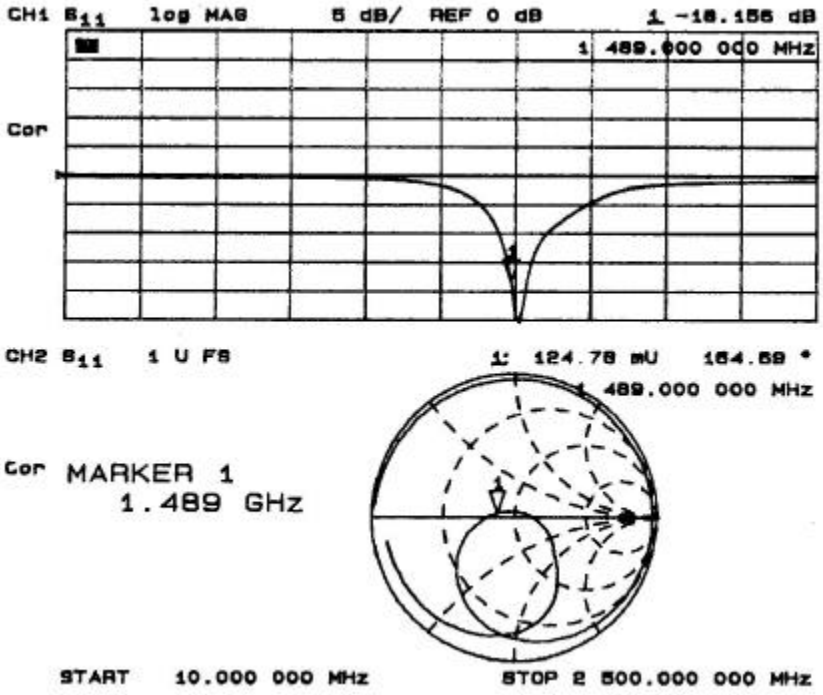


Condition
f_{IF}=130MHz
f_{RF1}=1489.0MHz, P_{RF}=-30dBm
f_{RF2}=1489.1MHz
f_{LO}=1619MHz, f_{LO}=-10dBm

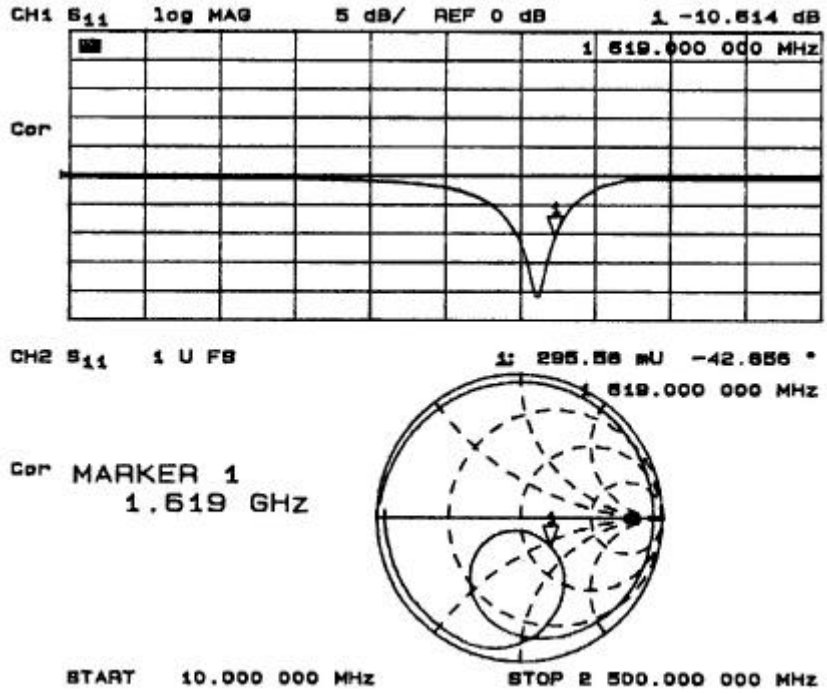
$$IIP3=\frac{3IF-IM3}{2}-G_c$$

@P_{RF}=-30dBm

■**TYPICAL CHARACTERISTICS** (Continued)

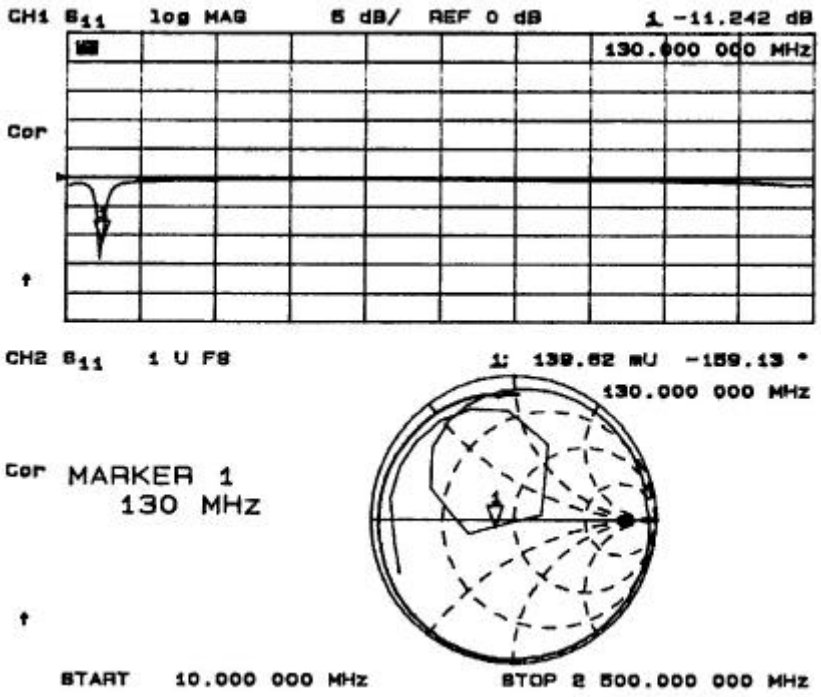


RFIN PORT EXTERNAL MATCHING NETWORK IMPEDANCE PLOT



LOIN PORT EXTERNAL MATCHING NETWORK IMPEDANCE PLOT

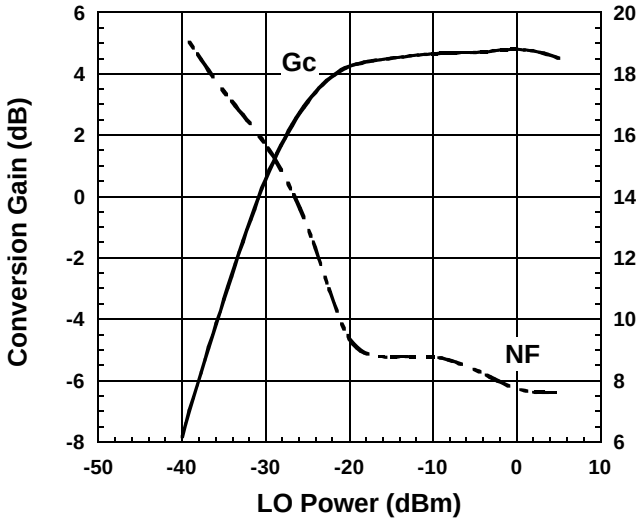
■**TYPICAL CHARACTERISTICS** (Continued)



IFOUT PORT EXTERNAL MATCHING NETWORK IMPEDANCE PLOT

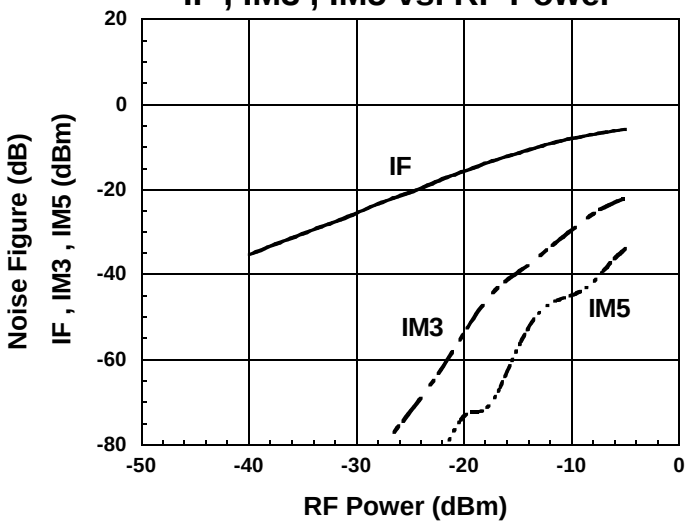
■**TYPICAL CHARACTERISTICS** (Application 1, f=1.9GHz, f_{LO}=1660MHz)

Conversion Gain , Noise Figure vs. LO Power



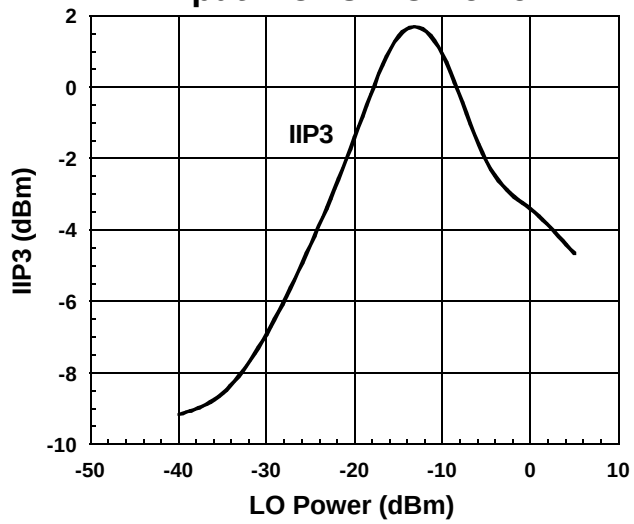
Condition
f_{IF}=240MHz
f_{RF}=1900MHz, P_{RF}=-30dBm
f_{LO}=1660MHz
V_{MIX}=V_{LO}=2.7V

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

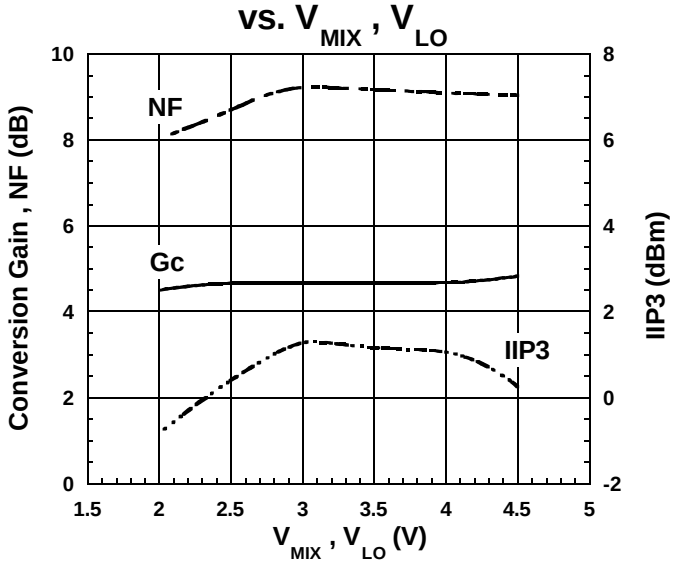


Condition
f_{IF}=240MHz
f_{RF1}=1900.0MHz, P_{RF}=-25dBm
f_{RF2}=1900.1MHz
f_{LO}=1660MHz
V_{MIX}=V_{LO}=2.7V

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

@P_{RF}=-25dBm

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



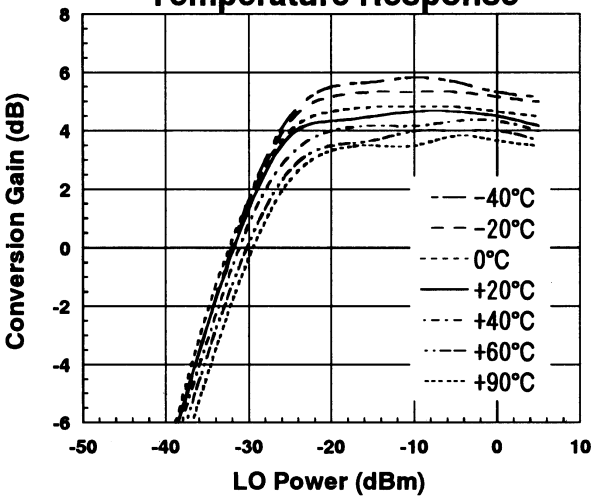
Condition
f_{IF}=240MHz
f_{RF1}=1900.0MHz, P_{RF}=-30dBm
f_{RF2}=1900.1MHz
f_{LO}=1660MHz, P_{LO}=-10dBm

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

@P_{RF}=-25dBm

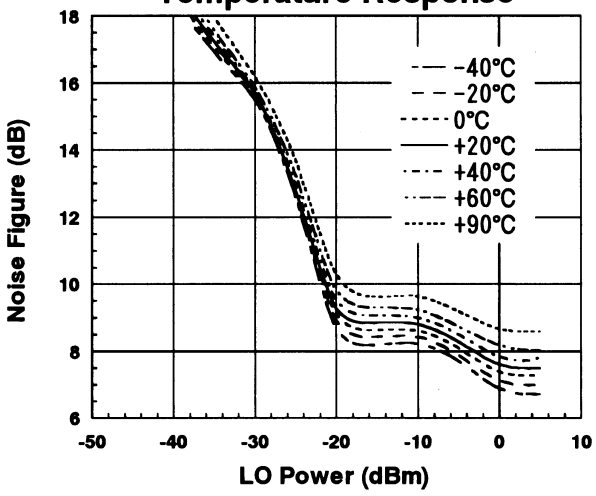
■TYPICAL CHARACTERISTICS (Continued)

Conversion Gain vs. LO Power Temperature Response



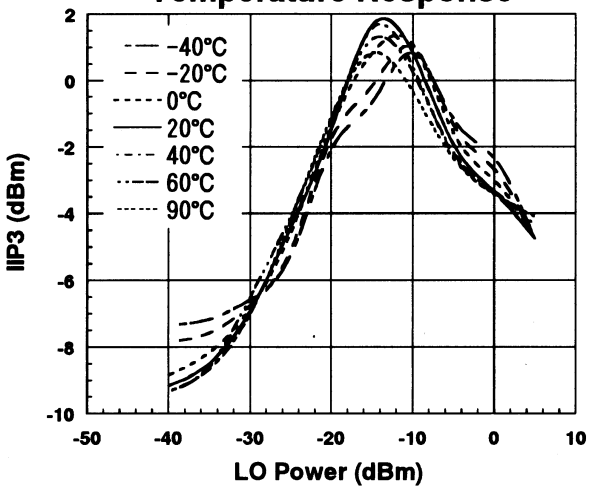
Condition
f_{IF}=240MHz
f_{RF}=1900MHz, P_{RF}=-30dBm
f_{LO}=1660MHz
V_{MIX}=V_{LO}=2.7V

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

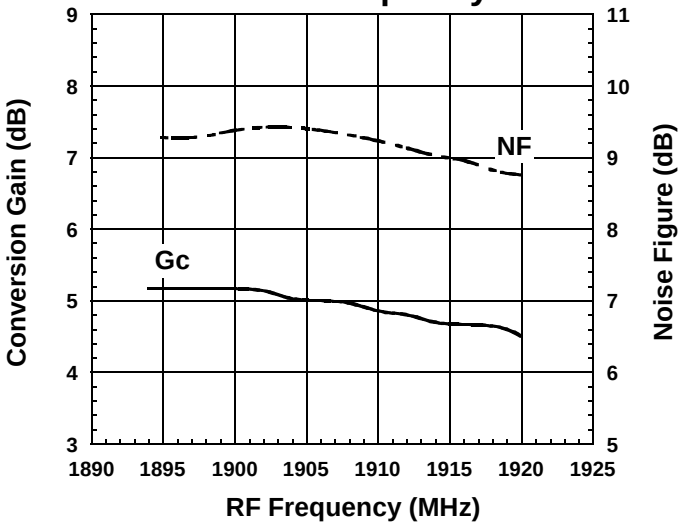


Condition
f_{IF}=240MHz
f_{RF1}=1900.0MHz, P_{RF}=-25dBm
f_{RF2}=1900.1MHz
f_{LO}=1660MHz
V_{MIX}=V_{LO}=2.7V

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

@P_{RF}=-25dBm

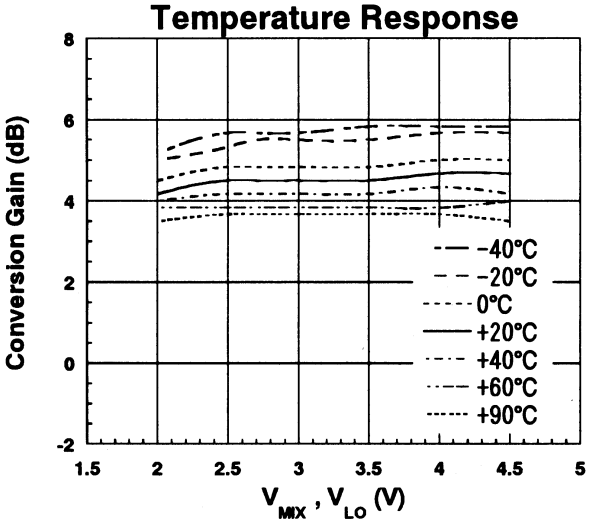
Conversion Gain , Noise Figure vs. RF Frequency



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

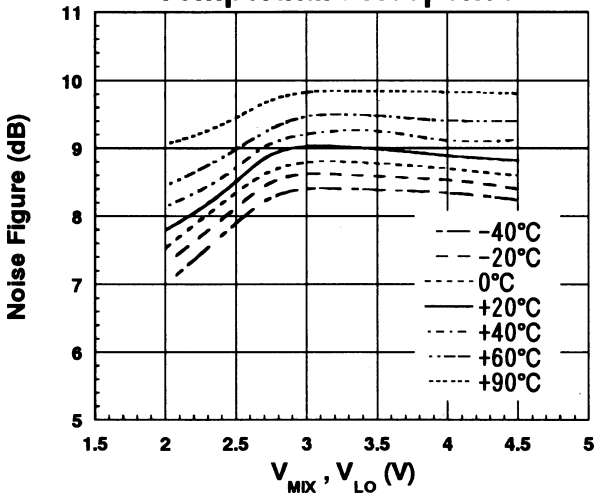
■**TYPICAL CHARACTERISTICS** (Continued)

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



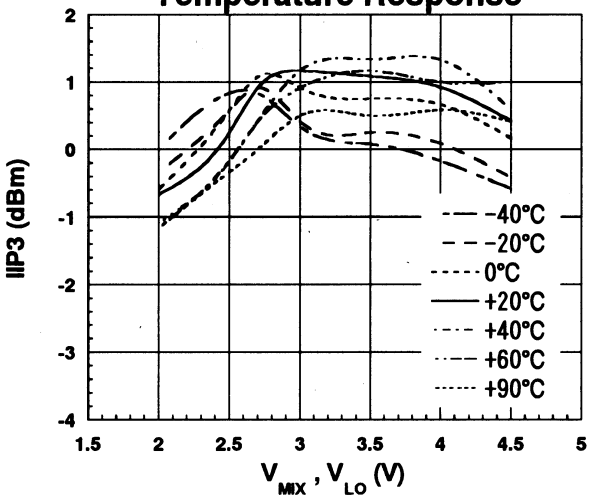
Condition
f_{IF}=240MHz
f_{RF}=1900MHz, P_{RF}=-30dBm
f_{LO}=1660MHz, P_{LO}=-10dBm

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

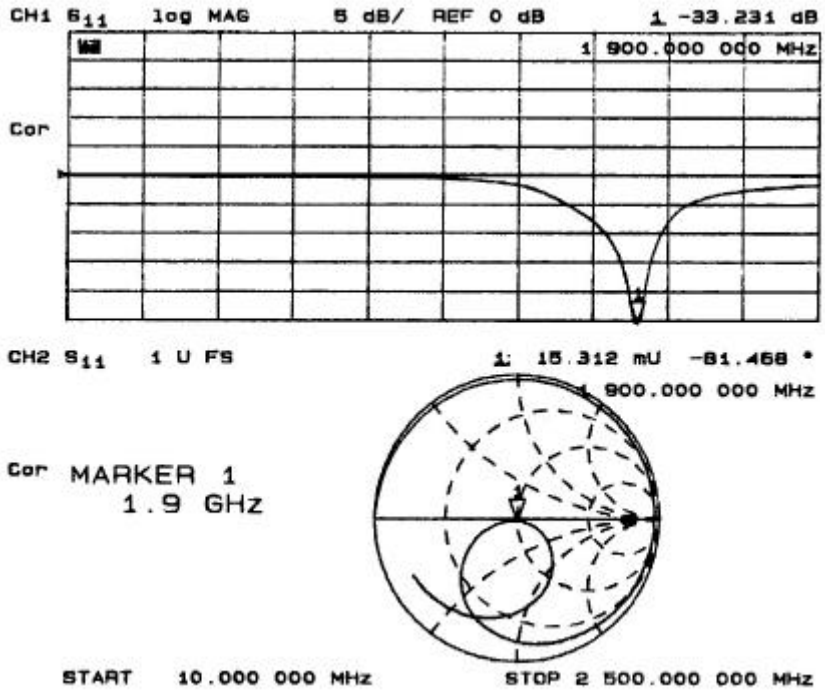


Condition
f_{IF}=240MHz
f_{RF1}=1900.0MHz, P_{RF}=-25dBm
f_{RF2}=1900.1MHz
f_{LO}=1660MHz, f_{LO}=-10dBm

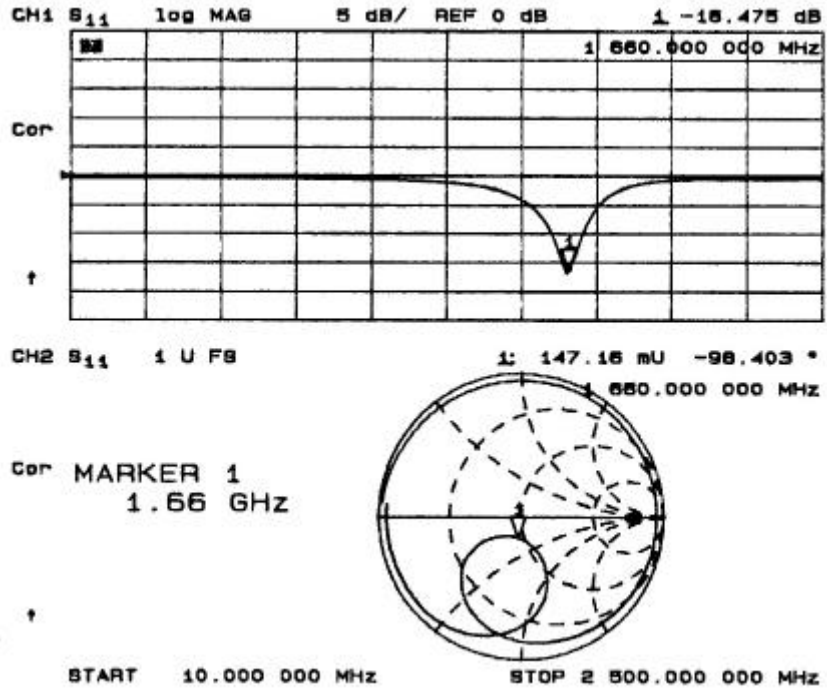
$$IIP3=\frac{3IF\text{-}IM3}{2}-G_c$$

@P_{RF}=-25dBm

■**TYPICAL CHARACTERISTICS** (Continued)

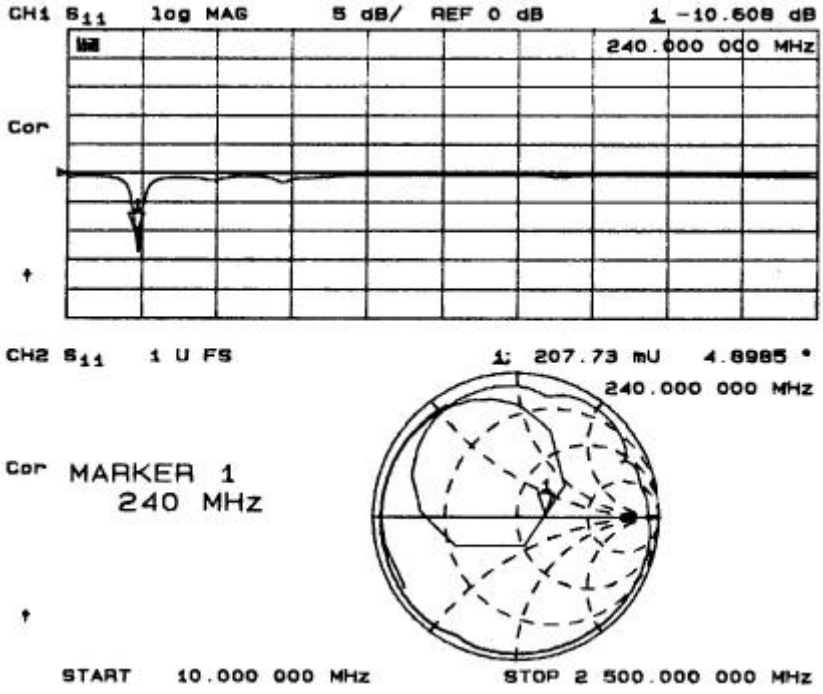


RFIN PORT EXTERNAL MATCHING NETWORK IMPEDANCE PLOT



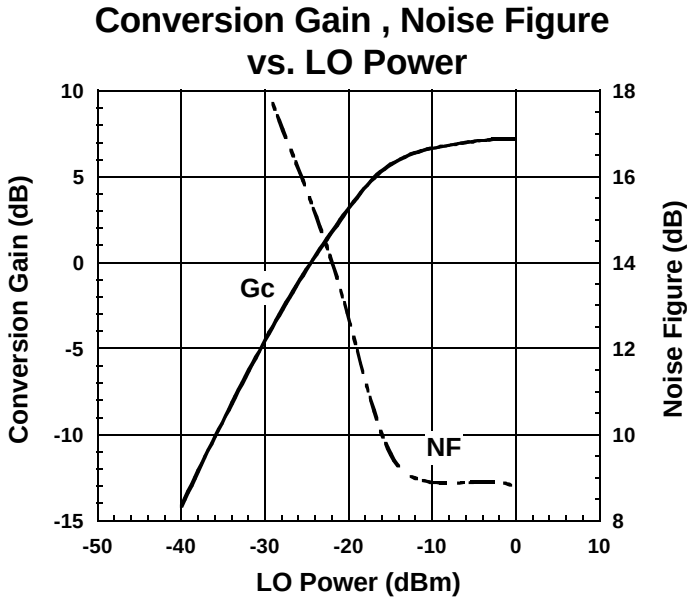
LOIN PORT EXTERNAL MATCHING NETWORK IMPEDANCE PLOT

■**TYPICAL CHARACTERISTICS** (Continued)

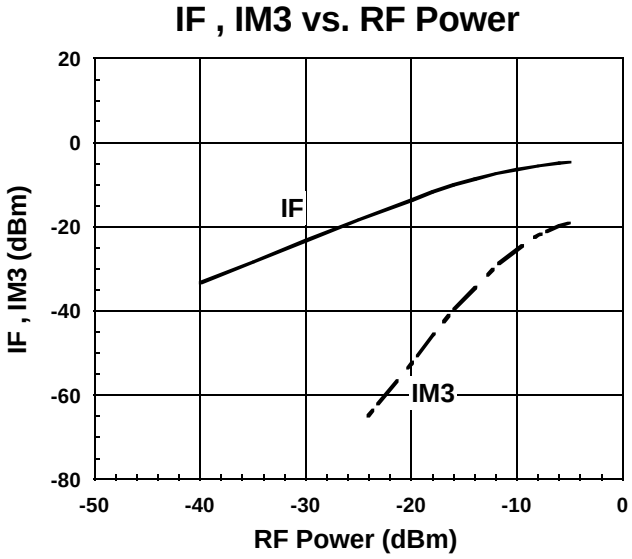


IFOUT PORT EXTERNAL MATCHING NETWORK IMPEDANCE PLOT

■**TYPICAL CHARACTERISTICS** (Application 2, f=1.9GHz, f_{LO}=1634.62MHz)



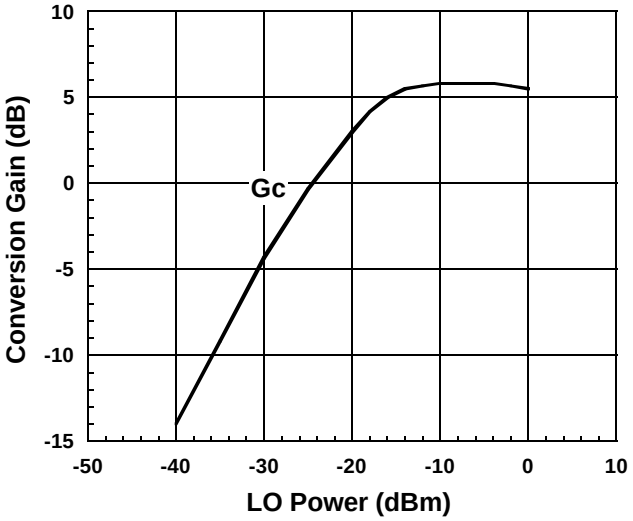
Condition
f_{IF}=220.38MHz
f_{RF}=1855MHz, P_{RF}=-30dBm
f_{LO}=1634.62MHz
V_{MIX}=V_{LO}=2.7V



Condition
f_{IF}=220.38MHz
f_{RF1}=1855.0MHz
f_{RF2}=1855.1MHz
f_{LO}=1634.62MHz, P_{LO}=-10dBm
V_{MIX}=V_{LO}=2.7V

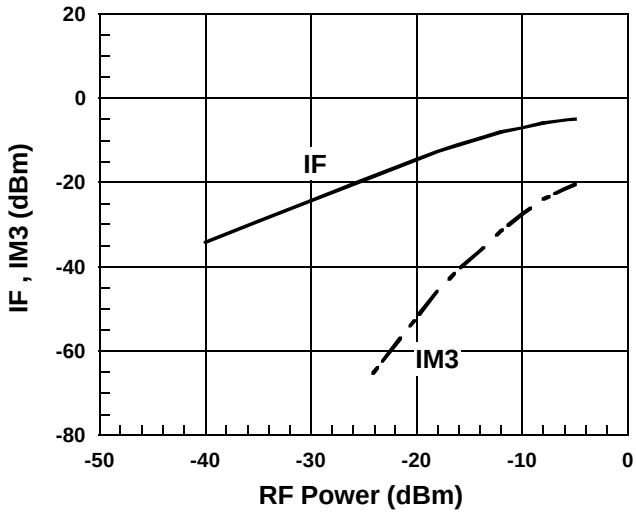
■**TYPICAL CHARACTERISTICS** (Application 2, f=1.9GHz, f_{LO}=1749.62MHz)

Conversion Gain vs. LO Power



Condition
f_{IF}=210.38MHz
f_{RF}=1960MHz, P_{RF}=-30dBm
f_{LO}=1749.62MHz
V_{MIX}=V_{LO}=2.7V

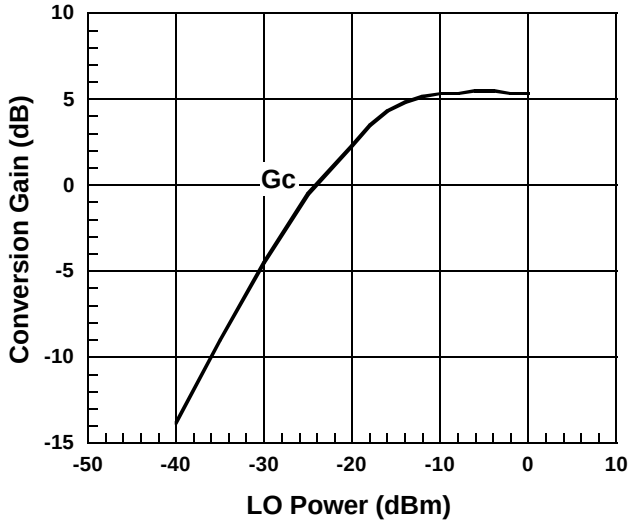
IF , IM3 vs. RF Power



Condition
f_{IF}=210.38MHz
f_{RF1}=1960.0MHz
f_{RF2}=1960.1MHz
f_{LO}=1749.62MHz, P_{LO}=-10dBm
V_{MIX}=V_{LO}=2.7V

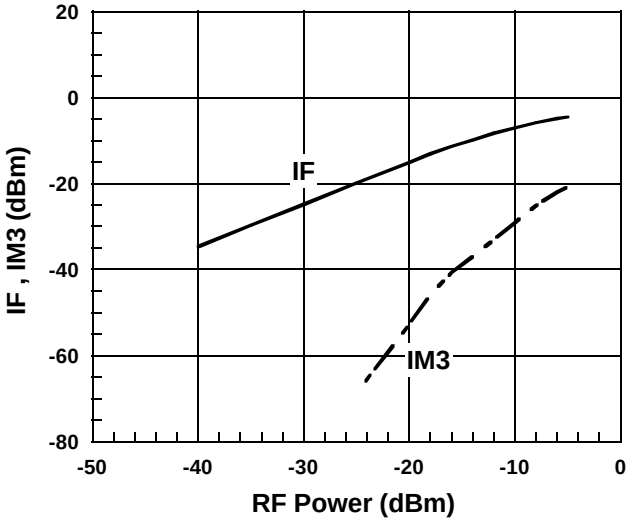
■**TYPICAL CHARACTERISTICS** (Application 2, f=2.1GHz, f_{LO}=1914.62MHz)

Conversion Gain vs. LO Power



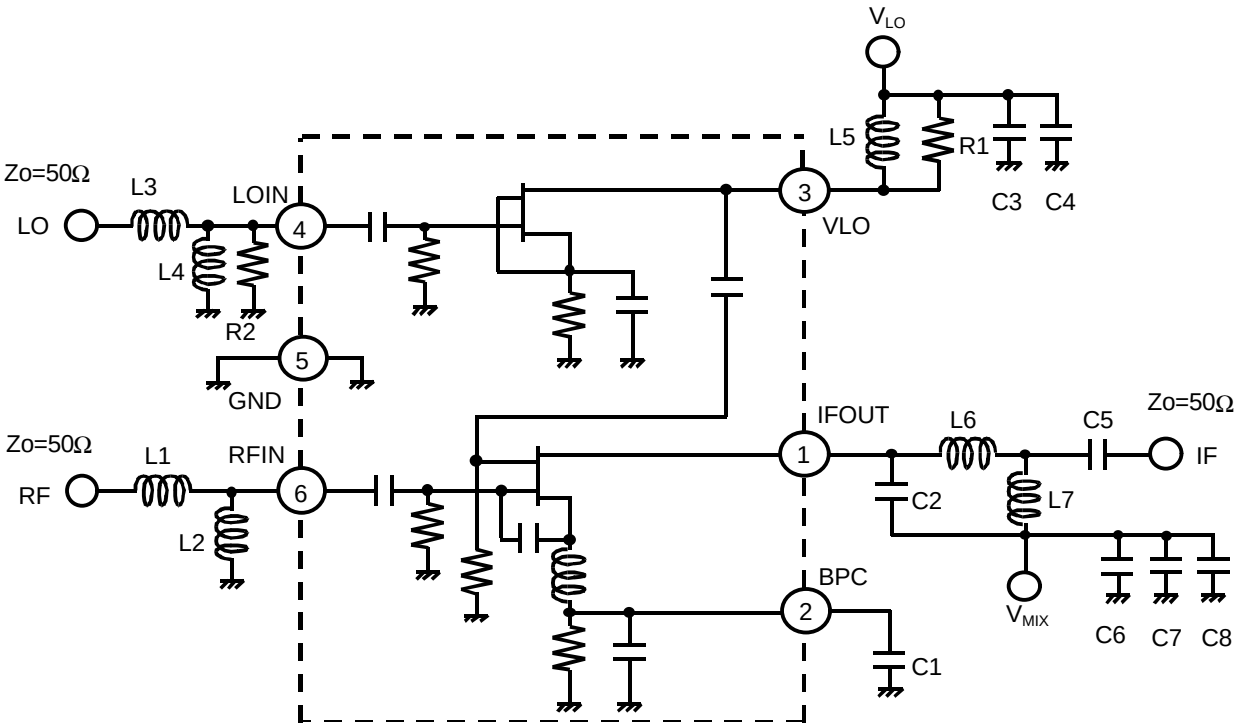
Condition
f_{IF}=220.38MHz
f_{RF}=2135MHz, P_{RF}=-30dBm
f_{LO}=1914.62MHz
V_{MIX}=V_{LO}=2.7V

IF , IM3 vs. RF Power



Condition
f_{IF}=220.38MHz
f_{RF1}=2135.0MHz
f_{RF2}=2135.1MHz
f_{LO}=1914.62MHz, P_{LO}=-10dBm
V_{MIX}=V_{LO}=2.7V

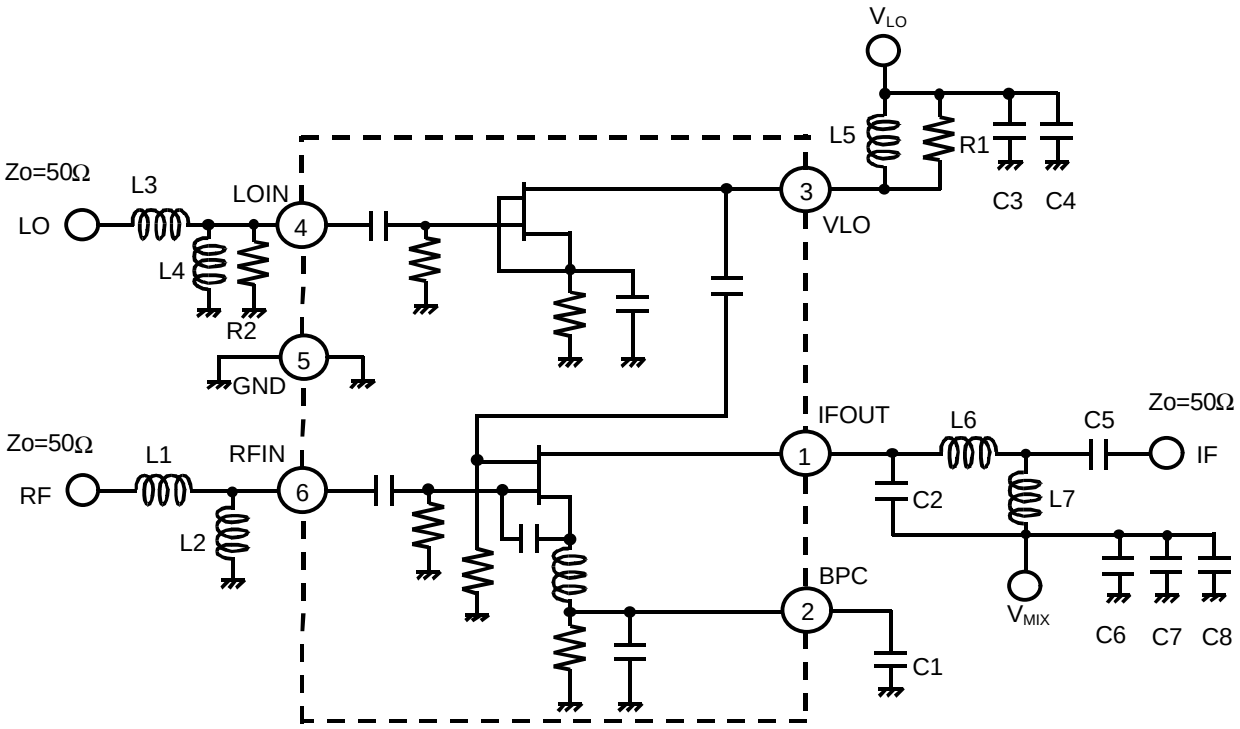
■APPLICATION CIRCUIT 1



PARTS LIST

PART ID	1.5GHz Band Upper LOCAL f_{LO}=1619MHz f_{IF}=130MHz	1.9GHz Band Lower LOCAL f_{LO}=1660MHz f_{IF}=240MHz	COMMENT
L1	10nH	6.8nH	TAIYO-YUDEN(HK1608)
L2	8.2nH	4.7nH	TAIYO-YUDEN(HK1608)
L3	15nH	15nH	TAIYO-YUDEN(HK1608)
L4	12nH	10nH	TAIYO-YUDEN(HK1608)
L5	5.6nH	4.7nH	TAIYO-YUDEN(HK1608)
L6	100nH	33nH	TAIYO-YUDEN(HK1608)
L7	47nH	15nH	TAIYO-YUDEN(HK1608)
C1	1000pF	560pF	MURATA(GRM39)
C2	11pF	8pF	MURATA(GRM39)
C3	10pF	10pF	MURATA(GRM39)
C4	100pF	100pF	MURATA(GRM39)
C5	1000pF	1000pF	MURATA(GRM39)
C6	10pF	10pF	MURATA(GRM39)
C7	100pF	100pF	MURATA(GRM39)
C8	1000pF	1000pF	MURATA(GRM39)
R1	390Ω	390Ω	TAMA Electronics(CRG16G)
R2	1KΩ	1KΩ	TAMA Electronics(CRG16G)

■APPLICATION CIRCUIT 2

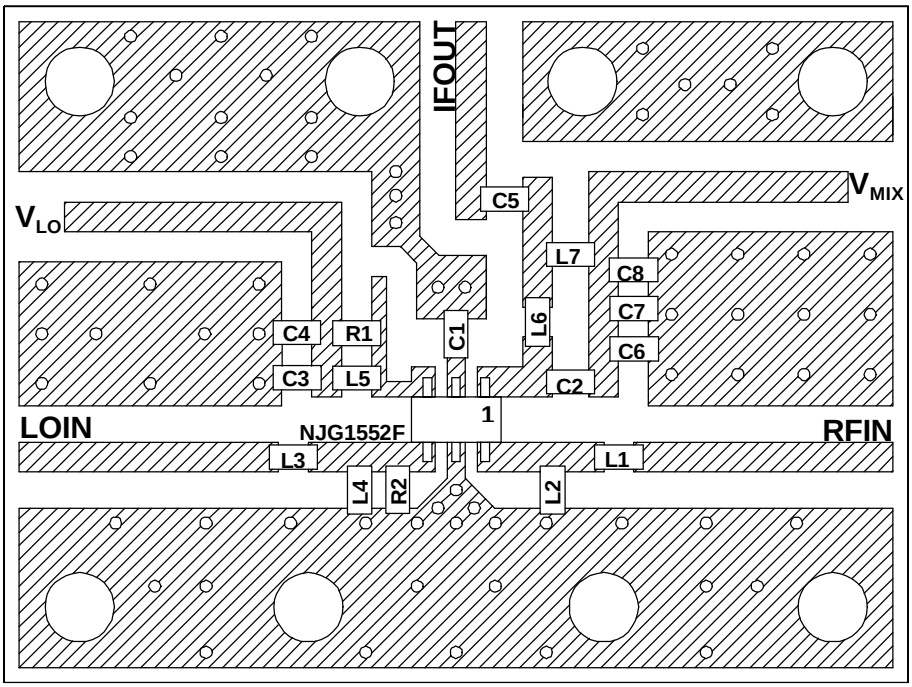


PARTS LIST

PART ID	1.9GHz Band		2.1GHz Band	COMMENT
	Lower LOCAL	Lower LOCAL	Lower LOCAL	
	f_{LO}=1634.62MHz f_{IF}=220.38MHz	f_{LO}=1749.62MHz f_{IF}=210.38MHz	f_{LO}=1914.62MHz f_{IF}=220.38MHz	
L1	6.8nH	6.8nH	4.7nH	TAIYO-YUDEN(HK1608)
L2	3.9nH	4.7nH	3.9nH	TAIYO-YUDEN(HK1608)
L3	12nH	12nH	10nH	TAIYO-YUDEN(HK1608)
L4	10nH	8.2nH	8.2nH	TAIYO-YUDEN(HK1608)
L5	6.8nH	5.6nH	4.7nH	TAIYO-YUDEN(HK1608)
L6	47nH	39nH	47nH	TAIYO-YUDEN(HK1608)
L7	22nH	22nH	18nH	TAIYO-YUDEN(HK1608)
C1	560pF	560pF	560pF	MURATA(GRM39)
C2	7pF	8pF	8pF	MURATA(GRM39)
C3	10pF	10pF	10pF	MURATA(GRM39)
C4	100pF	100pF	100pF	MURATA(GRM39)
C5	1000pF	1000pF	1000pF	MURATA(GRM39)
C6	10pF	10pF	10pF	MURATA(GRM39)
C7	100pF	100pF	100pF	MURATA(GRM39)
C8	1000pF	1000pF	1000pF	MURATA(GRM39)
R1	240Ω	270Ω	330Ω	TAMA Electronics(CRG16G)
R2	430Ω	470Ω	470Ω	TAMA Electronics(CRG16G)

■RECOMMENDED PCB DESIGN

(TOP VIEW)



(SIZE: 22.5mmx30mm)

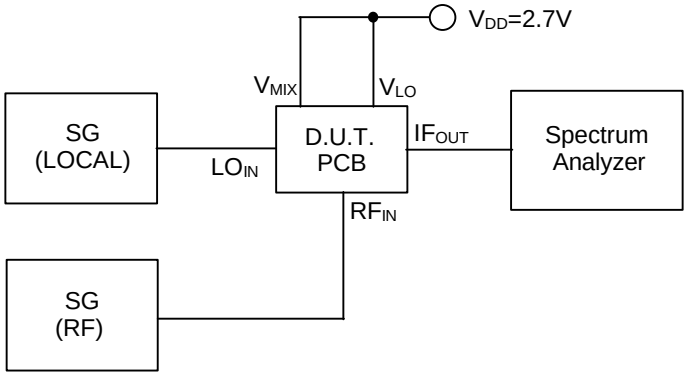
PCB: FR-4, t=0.5mm

STRIPLINE WIDTH=1mm (Zo=50Ω)

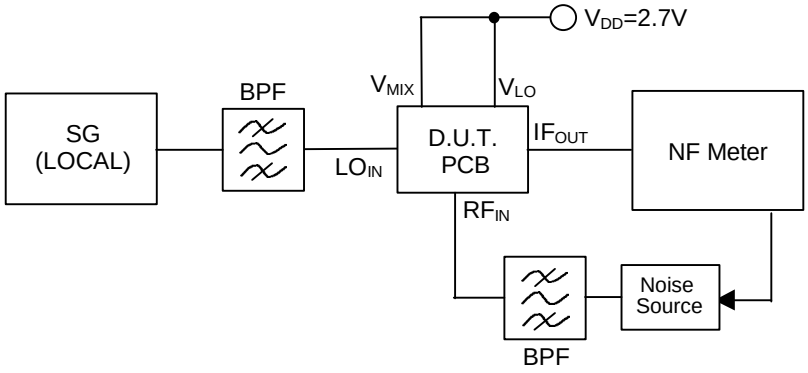
PRECAUTIONS

[1] Please locate L5 and R1 close to VLO terminal (3).
[2] Distance from L1 and RFIN terminal (6) is 3.5mm.
[3] Distance from L3 and LOIN terminal (4) is 3.5mm.
[4] Please locate C1 close to BPC terminal (2).
[5] Please locate C6, C7 and C8 close to C2, L7.
[6] Please locate C3, C4 close to R1, L5.

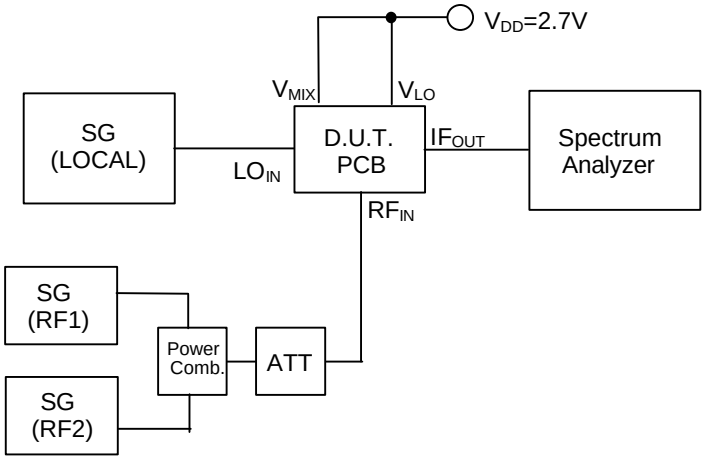
■MEASURING BLOCK DIAGRAM



Conversion Gain Measurement Block Diagram

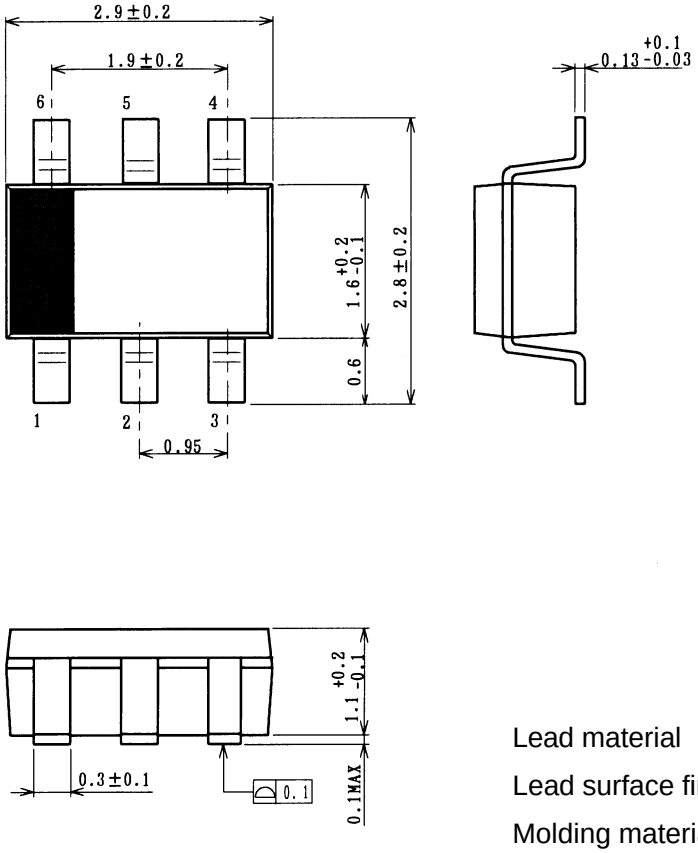


Noise Figure Measurement Block Diagram



IF, IM3, IM5 Measurement Block Diagram

■PACKAGE OUTLINE (MTP6)



Lead material	: Copper
Lead surface finish	: Solder plating
Molding material	: Epoxy resin
UNIT	: mm
Weight	: 14mg

Cautions on using this product

This product contains Gallium-Arsenide (GaAs) which is a harmful material.

- Do NOT eat or put into mouth.
- Do NOT dispose in fire or break up this product.
- Do NOT chemically make gas or powder with this product.
- To waste this product, please obey the relating law of your country.

This product may be damaged with electric static discharge (ESD) or spike voltage. Please handle with care to avoid these damages.