



# NJG1555KB2

03/22/2000 Ver.5  
TENTATIVE

## 800MHz BAND MIXER GaAs MMIC

### ■GENERAL DESCRIPTION

NJG1555KB2 is a mixer GaAs MMIC features low distortion, high conversion gain and low noise figure.

NJG1555KB2 includes a mixer and a local amplifier, and ideally suitable for 800MHz band digital mobile phone handsets.

An ultra small & ultra thin FLP6-B2 package is adopted.

### ■PACKAGE OUTLINE

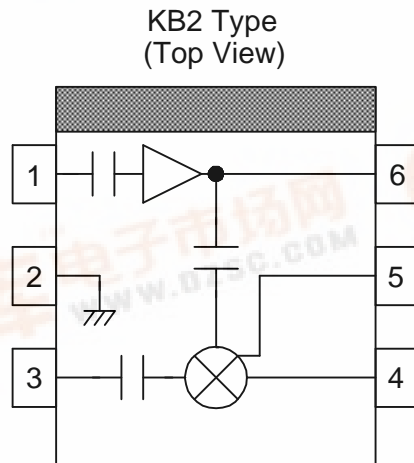


NJG1555KB2

### ■FEATURES

- Low voltage operation +2.7V
- High conversion gain 12dB typ. @ $f_{RF}=820\text{MHz}$ ,  $P_{LO}=-15\text{dBm}$
- High Input IP3 +1dBm typ. @ $f_{RF}=820.0+820.1\text{MHz}$ ,  $P_{LO}=-15\text{dBm}$
- Low noise figure 5dB typ. @ $f_{RF}=820\text{MHz}$ ,  $P_{LO}=-15\text{dBm}$
- Ultra small & ultra thin package FLP6-B2 (Mount Size: 2.1x2.0x0.75mm)

### ■PIN CONFIGURATION



#### Pin Connection

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

NOTE: The portion above shows orientation mark printed on the package surface.

NOTE: Please note that any information on this catalog will be subject to change.



# NJG1555KB2

## ■ABSOLUTE MAXIMUM RATINGS

( $T_a=25^{\circ}\text{C}$ ,  $Z_s=Z_l=50\Omega$ )

PARAMETERS	SYMBOL	CONDITIONS	RATINGS	UNITS
Mixer Supply Voltage	$V_{\text{MIX}}$		5	V
Local Amplifier Supply Voltage	$V_{\text{LO}}$		5	V
Mixer RF Input Power	$P_{\text{RFIN}}$	$V_{\text{MIX}}=2.7\text{V}$ , $V_{\text{LO}}=2.7\text{V}$	10	dBm
Mixer LO Input Power	$P_{\text{LOIN}}$	$V_{\text{MIX}}=2.7\text{V}$ , $V_{\text{LO}}=2.7\text{V}$	10	dBm
Power Dissipation	$P_{\text{D}}$		450	mW
Operating Temperature	$T_{\text{opr}}$		-40~+85	$^{\circ}\text{C}$
Storage Temperature	$T_{\text{stg}}$		-55~+125	$^{\circ}\text{C}$

## ■ELECTRICAL CHARACTERISTICS

GENERAL CONDITIONS:  $T_a=25^{\circ}\text{C}$ ,  $V_{\text{MIX}}=2.7\text{V}$ ,  $V_{\text{LO}}=2.7\text{V}$ ,  $f_{\text{RF}}=820\text{MHz}$ ,  $f_{\text{LO}}=690\text{MHz}$   
 $P_{\text{RF}}=-30\text{dBm}$ ,  $P_{\text{LO}}=-15\text{dBm}$ ,  $Z_s=Z_l=50\Omega$ , with test circuit

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Frequency	freq		800	820	900	MHz
Mixer Supply Voltage	$V_{\text{MIX}}$		2.5	2.7	4.5	V
Local Amplifier Supply Voltage	$V_{\text{LO}}$		2.5	2.7	4.5	V
Mixer Current	$I_{\text{MIX}}$	$P_{\text{RF}}=\text{OFF}$ , $P_{\text{LO}}=\text{OFF}$	-	5.0	7.0	mA
Local Amplifier Current	$I_{\text{LO}}$	$P_{\text{RF}}=\text{OFF}$ , $P_{\text{LO}}=\text{OFF}$	-	1.0	1.6	mA
Conversion Gain	$G_{\text{C}}$		10.0	12.0	-	dB
Input 3rd Order Intercept point	IIP3	$f_{\text{RF}}=820.0\text{MHz}+820.1\text{MHz}$	-1.0	+1.0	-	dBm
Noise Figure	NF		-	5.0	6.0	dB
LO to RF Isolation	ISL	IF OUT Port : $50\Omega$ term.	-	9.0	-	dB

## ■ TERMINAL INFORMATION

PIN No.	SYMBOL	DESCRIPTIONS
1	LOIN	Local power input terminal of local amplifier. External matching circuit is required.
2	GND	Ground terminal (0V).
3	RFIN	RF input terminal of mixer. External matching circuit is required.
4	IFOUT	IF signal output terminal for mixer external matching circuit is required. Please connect mixer power supply through choke inductor (L6) as shown in test circuit.
5	BPC	Optional bypass capacitor terminal for mixer. Please connect optimum capacitor if need for tuning Gc or IP3.
6	VLO	Local amplifier supply terminal. Please place R1 & L4 close to this terminal as shown in test circuit.

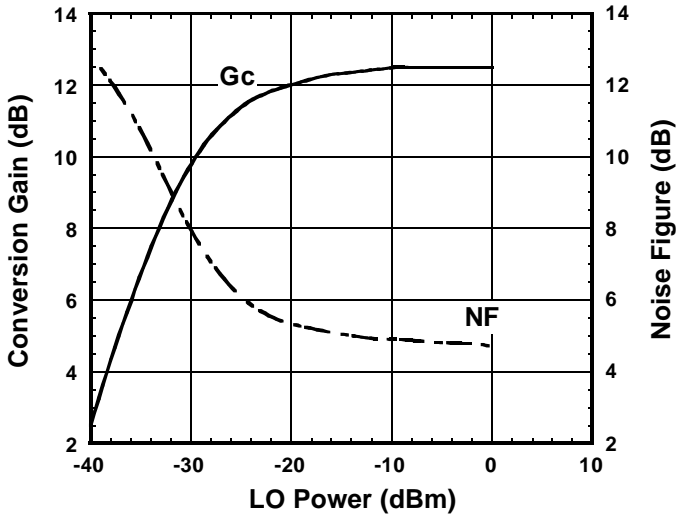
### NOTE:

- 1) Ground terminal (2pin) should be connected with ground plane by multiple via holes for good grounding.

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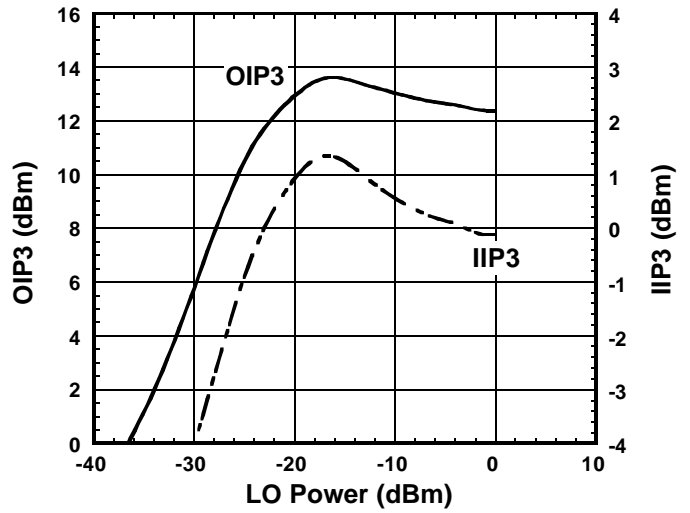
## ■ TYPICAL CHARACTERISTICS ( $f_{LO}=690\text{MHz}$ )

**Conversion Gain , Noise Figure vs. LO Power**



Condition  
 $f_{IF}=130\text{MHz}$   
 $f_{RF}=820\text{MHz}$ ,  $P_{RF}=-30\text{dBm}$   
 $f_{LO}=690\text{MHz}$   
 $V_{MIX}=V_{LO}=2.7\text{V}$

**Output IP3 , Input IP3 vs. LO Power**

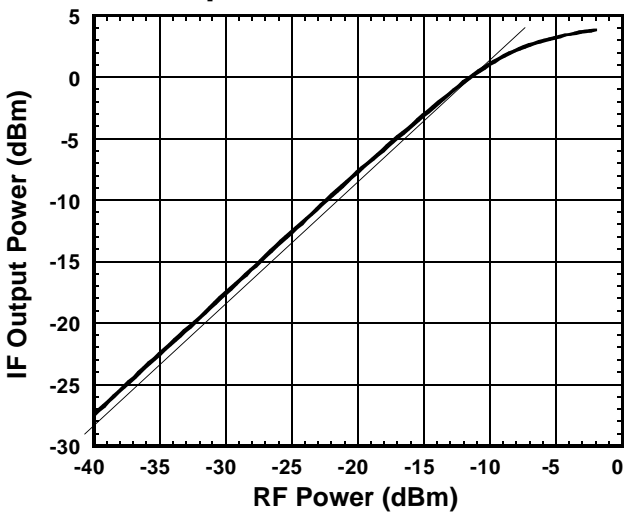


Condition  
 $f_{IF}=130\text{MHz}$   
 $f_{RF}=820.0+820.1\text{MHz}$   
 $P_{RF}=-30\text{dBm}$   
 $f_{LO}=690\text{MHz}$   
 $V_{MIX}=V_{LO}=2.7\text{V}$

$$\text{OIP3} = \frac{3 \times \text{IF} - \text{IM3}}{2}$$

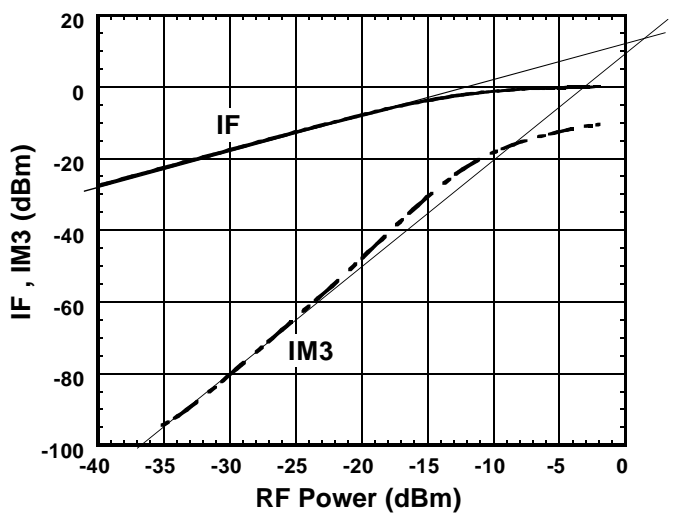
$$\text{IIP3} = \text{OIP3} - G_c$$

**IF Output Power vs. RF Power**



Condition  
 $f_{IF}=130\text{MHz}$   
 $f_{RF}=820\text{MHz}$   
 $f_{LO}=690\text{MHz}$ ,  $P_{LO}=-15\text{dBm}$   
 $V_{MIX}=V_{LO}=2.7\text{V}$

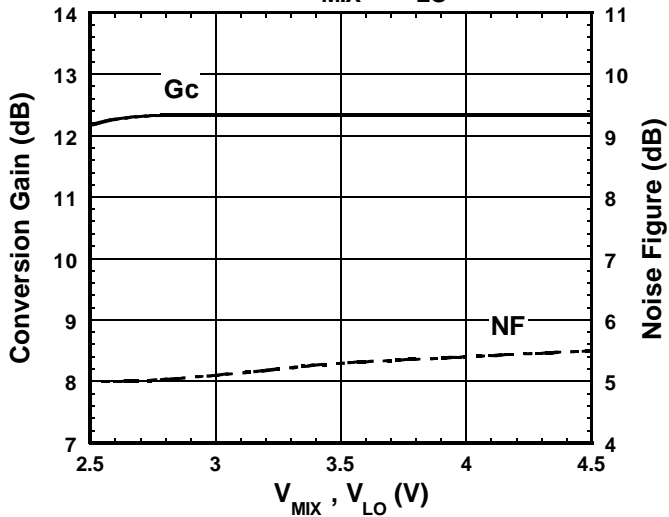
**IF , IM3 vs. RF Power**



Condition  
 $f_{IF}=130\text{MHz}$   
 $f_{RF}=820.0+820.1\text{MHz}$   
 $f_{LO}=690\text{MHz}$ ,  $P_{LO}=-15\text{dBm}$   
 $V_{MIX}=V_{LO}=2.7\text{V}$

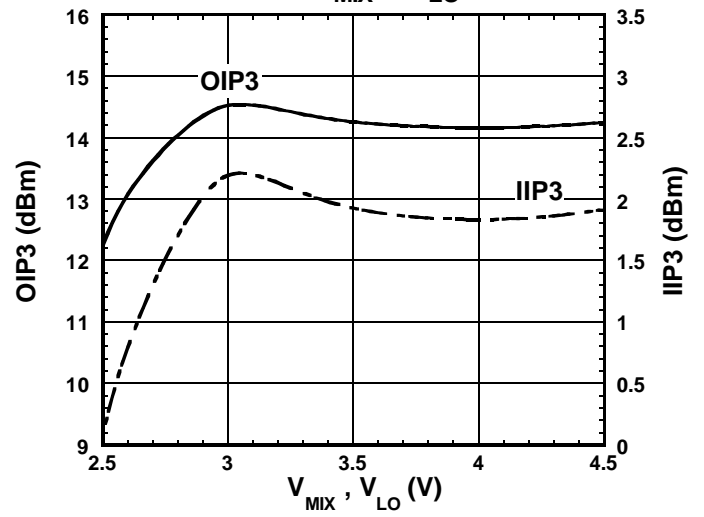
## ■ TYPICAL CHARACTERISTICS (Continued)

### Conversion Gain , Noise Figure vs. $V_{MIX}$ , $V_{LO}$



Condition  
 $f_{IF}=130\text{MHz}$   
 $f_{RF}=820\text{MHz}$ ,  $P_{RF}=-30\text{dBm}$   
 $f_{LO}=690\text{MHz}$ ,  $P_{LO}=-15\text{dBm}$

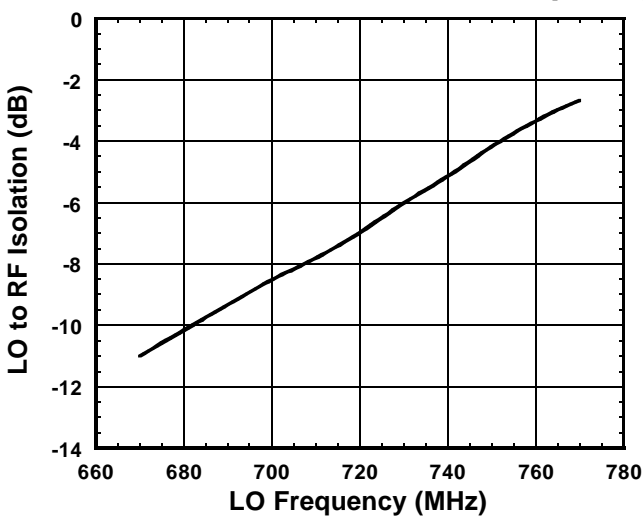
### Output IP3 , Input IP3 vs. $V_{MIX}$ , $V_{LO}$



Condition  
 $f_{IF}=130\text{MHz}$   
 $f_{RF}=820.0+820.1\text{MHz}$   
 $P_{RF}=-30\text{dBm}$   
 $f_{LO}=690\text{MHz}$ ,  $P_{LO}=-15\text{dBm}$

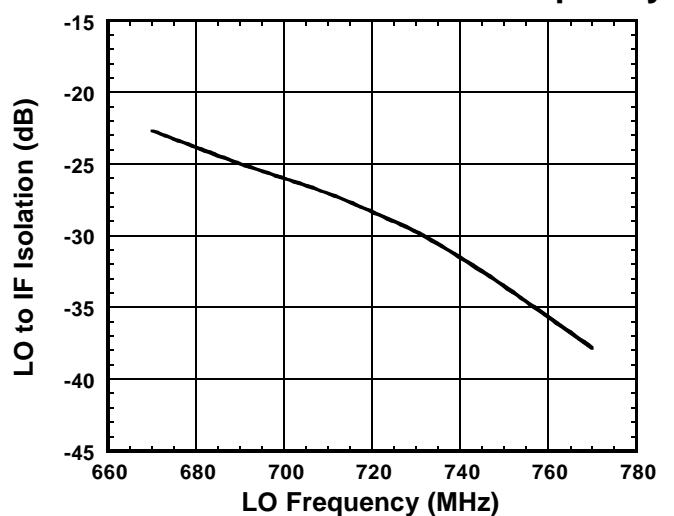
$OIP3 = \frac{3 \times IIP3 - IM3}{2}$   
 $IIP3 = OIP3 - Gc$

### LO to RF Isolation vs. LO Frequency



Condition  
 $f_{LO}=670\sim 770\text{MHz}$   
 $P_{LO}=-15\text{dBm}$   
 $V_{MIX}=V_{LO}=2.7\text{V}$   
 IF OUT Port:  $50\Omega$ term.

### LO to IF Isolation vs. LO Frequency

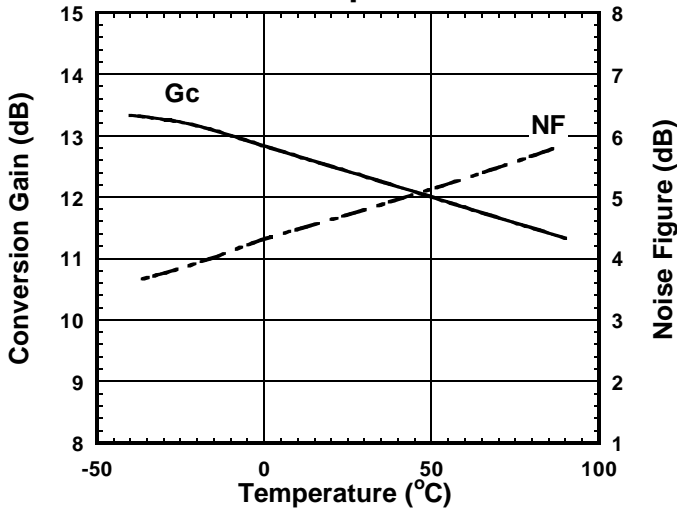


Condition  
 $f_{LO}=670\sim 770\text{MHz}$   
 $P_{LO}=-15\text{dBm}$   
 $V_{MIX}=V_{LO}=2.7\text{V}$   
 RF IN Port:  $50\Omega$ term.

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## ■ TYPICAL CHARACTERISTICS (Continued)

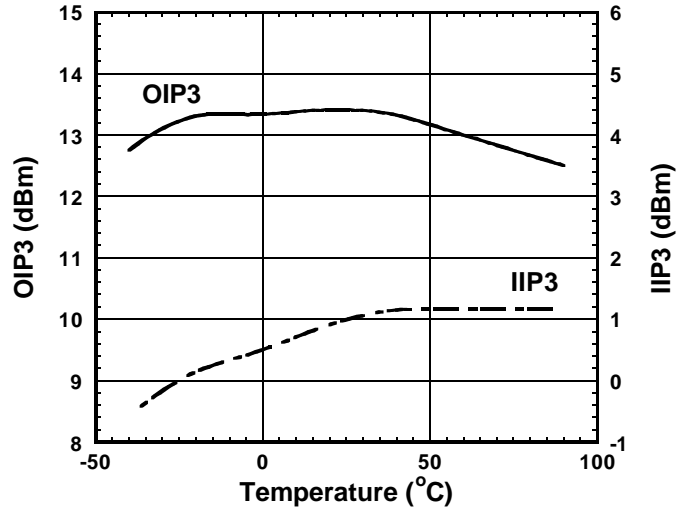
**Conversion Gain , Noise Figure vs. Temperature**



Condition

$f_{IF}=130\text{MHz}$   
 $f_{RF}=820\text{MHz}$ ,  $P_{RF}=-30\text{dBm}$   
 $f_{LO}=690\text{MHz}$ ,  $P_{LO}=-15\text{dBm}$   
 $V_{MIX}=V_{LO}=2.7\text{V}$

**Output IP3 , Input IP3 vs. Temperature**

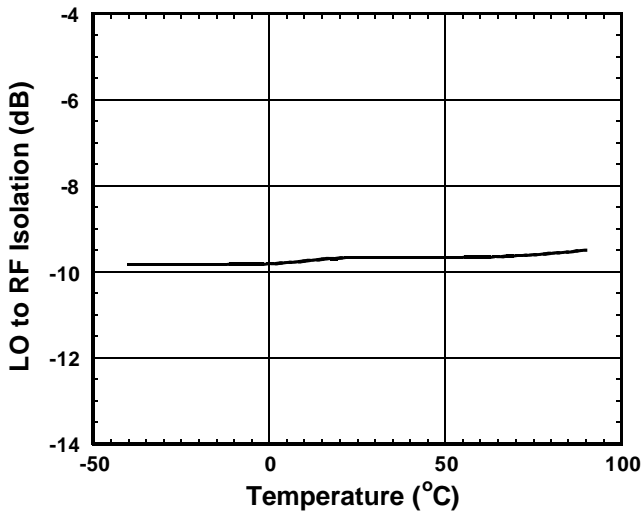


Condition

$f_{IF}=130\text{MHz}$   
 $f_{RF}=820.0+820.1\text{MHz}$   
 $P_{RF}=-30\text{dBm}$   
 $f_{LO}=690\text{MHz}$ ,  $P_{LO}=-15\text{dBm}$   
 $V_{MIX}=V_{LO}=2.7\text{V}$

$OIP3 = \frac{3 \times IF - IM3}{2}$   
 $IIP3 = OIP3 - Gc$

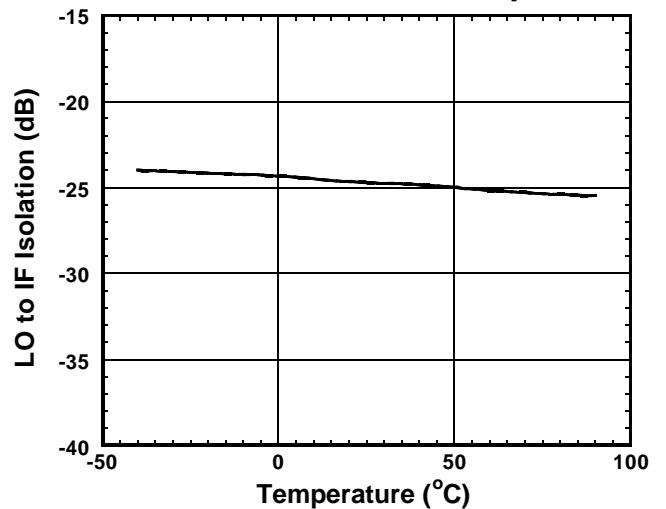
**LO to RF Isolation vs. Temperature**



Condition

$f_{LO}=690\text{MHz}$   
 $P_{LO}=-15\text{dBm}$   
 $V_{MIX}=V_{LO}=2.7\text{V}$   
 IF OUT Port:  $50\Omega$ term.

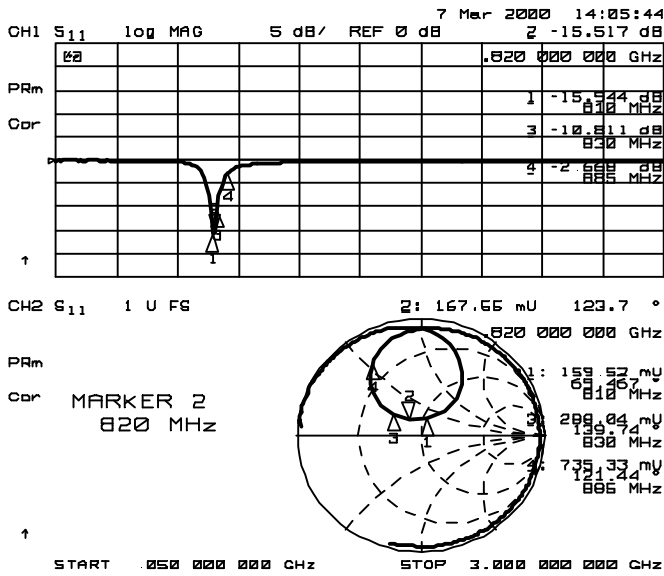
**LO to IF Isolation vs. Temperature**



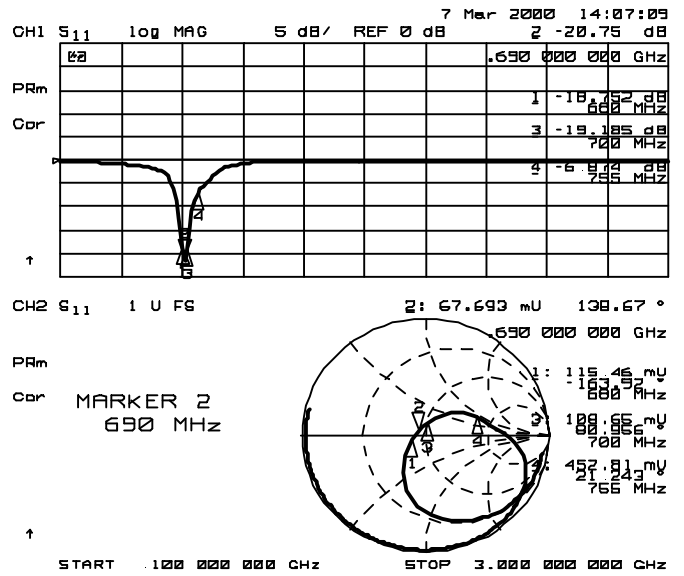
Condition

$f_{LO}=690\text{MHz}$   
 $P_{LO}=-15\text{dBm}$   
 $V_{MIX}=V_{LO}=2.7\text{V}$   
 RF IN Port:  $50\Omega$ term.

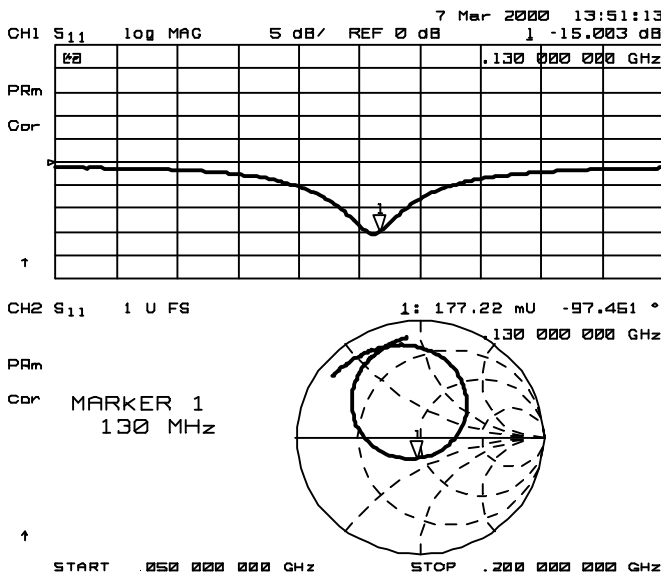
## ■ TYPICAL CHARACTERISTICS (Continued)



RF IN Port Impedance  
 (LOCAL IN Port, IF OUT Port : 50Ω term.)



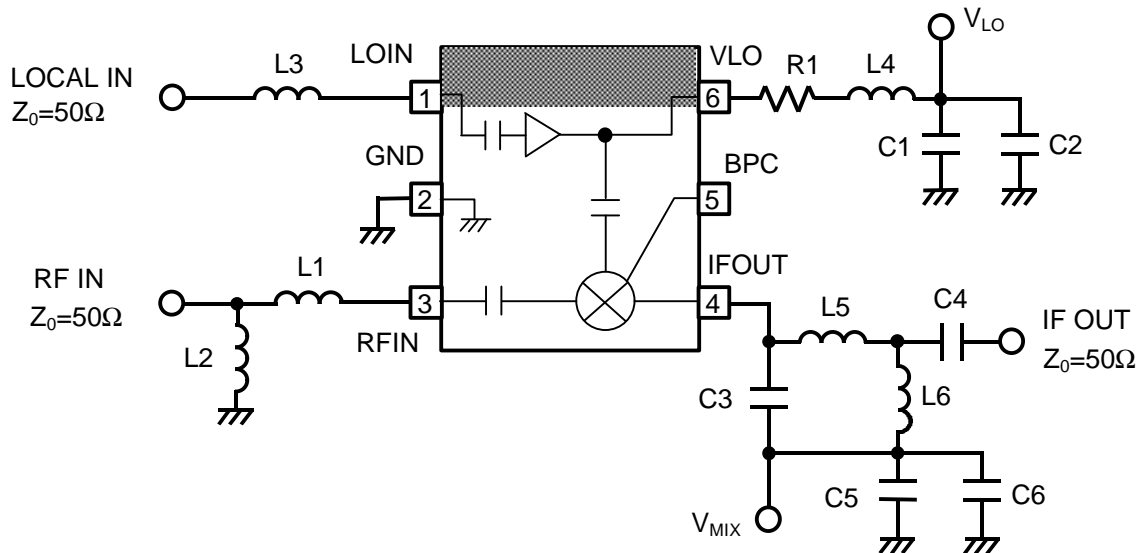
LOCAL IN Port Impedance  
 (RF IN Port, IF OUT Port : 50Ω term.)



IF OUT Port Impedance  
 (RF IN Port, LOCAL IN Port : 50Ω term.)

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## APPLICATION CIRCUIT



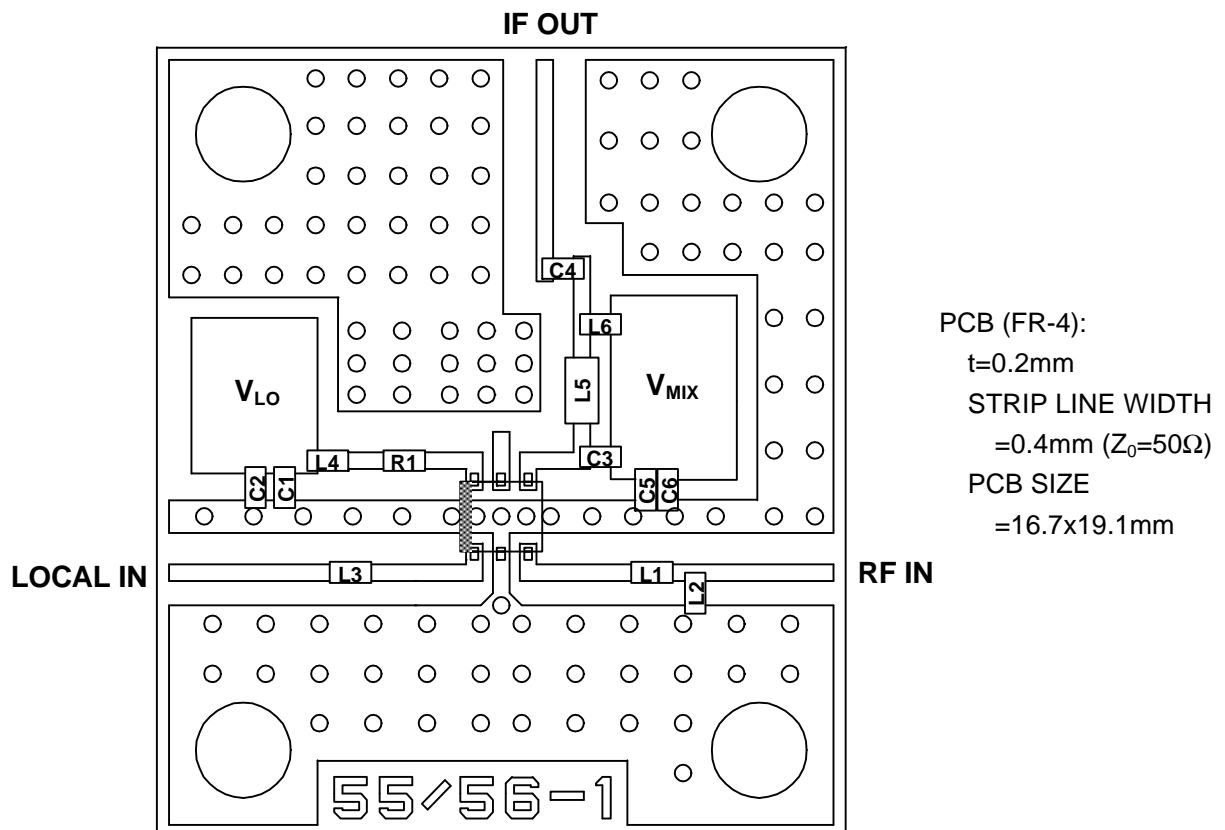
### PARTS LIST

PARTS ID	800MHz Band		COMMENT
	Lower LOCAL $f_{LO}=690\text{MHz}$ $f_{IF}=130\text{MHz}$	Upper LOCAL $f_{LO}=950\text{MHz}$ $f_{IF}=130\text{MHz}$	
L1	15nH	15nH	TAIYO-YUDEN (HK1005)
L2	3.9nH	3.9nH	TAIYO-YUDEN (HK1005)
L3	47nH	27nH	TAIYO-YUDEN (HK1005)
L4	39nH	22nH	TAIYO-YUDEN (HK1005)
L5	120nH	120nH	TAIYO-YUDEN (HK1608)
L6	56nH	56nH	TAIYO-YUDEN (HK1005)
C1	100pF	100pF	MURATA (GRM36)
C2	1000pF	1000pF	MURATA (GRM36)
C3	9pF	9pF	MURATA (GRM36)
C4	1000pF	1000pF	MURATA (GRM36)
C5	10pF	10pF	MURATA (GRM36)
C6	1000pF	1000pF	MURATA (GRM36)
R1	27Ω	22Ω	1005 Size



## RECOMMENDED PCB DESIGN

(Top View)

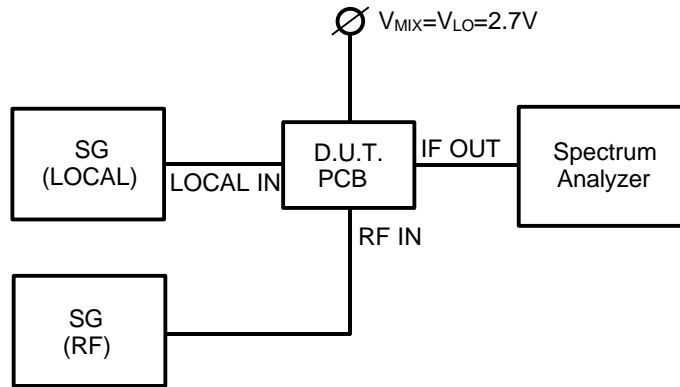


### PRECAUTIONS

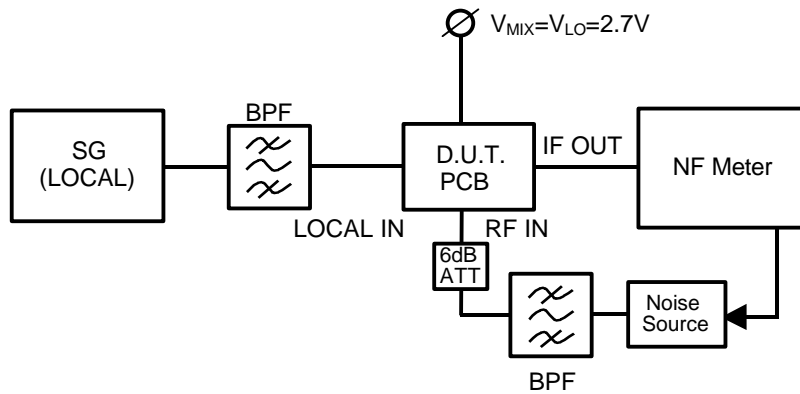
- [1] Please locate L4 and R1 close to V<sub>LO</sub> terminal (6).
- [2] Please locate C1 and C2 close to L4.
- [3] Please locate C5 and C6 close to C3.

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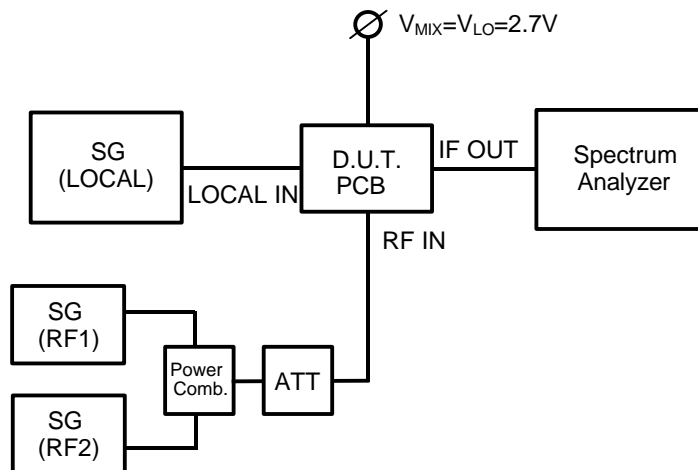
## MEASURING BLOCK DIAGRAM



Conversion Gain Measuring Block Diagram



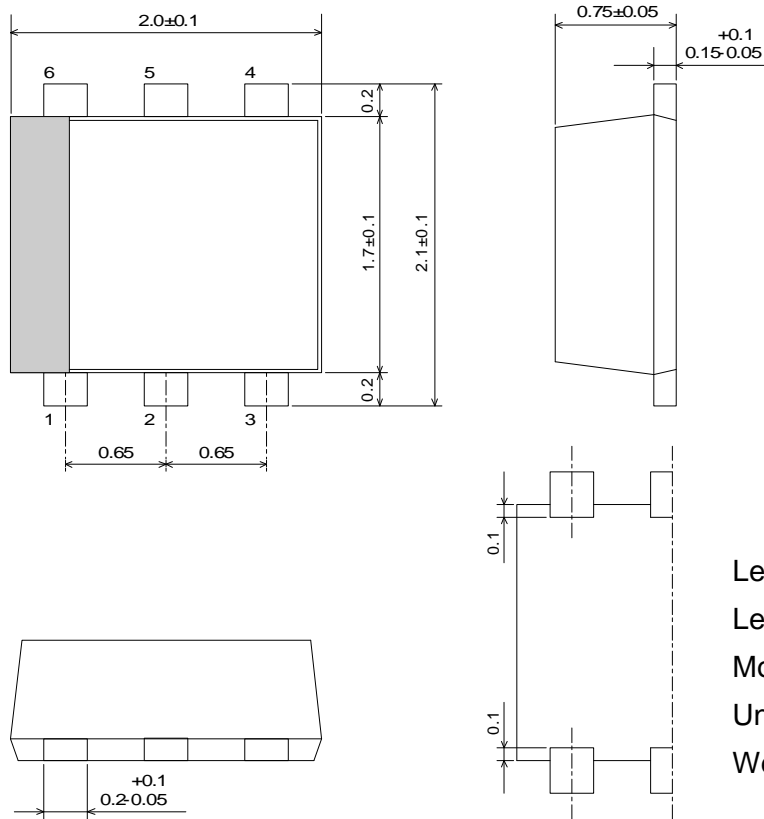
Noise Figure Measuring Block Diagram



OIP3, IIP3 Measuring Block Diagram

# NJG1555KB2

## PACKAGE OUTLINE (FLP6-B2)



Lead material	: Copper
Lead surface finish	: Solder plating
Molding material	: Epoxy resin
Unit	: mm
Weight	: 6.5mg

### 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.

### [CAUTION]

The specifications on this databook are only given for information, without any guarantee as regards either mistakes or omissions. The application circuits in this databook are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.

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