

800MHz BAND LOW NOISE AMPLIFIER GaAs MMIC

■GENERAL DESCRIPTION

NJG1106KB2 is a low noise amplifier GaAs MMIC designed for 800MHz band cellular phone handsets.

This amplifier provides low noise figure of 1.3dB and low current consumption of 3mA at low supply voltage of 2.7V.

NJG1106KB2 includes internal self-bias circuit and input DC blocking capacitor in a ultra small and ultra thin package of FLP6-B2.

■PACKAGE OUTLINE

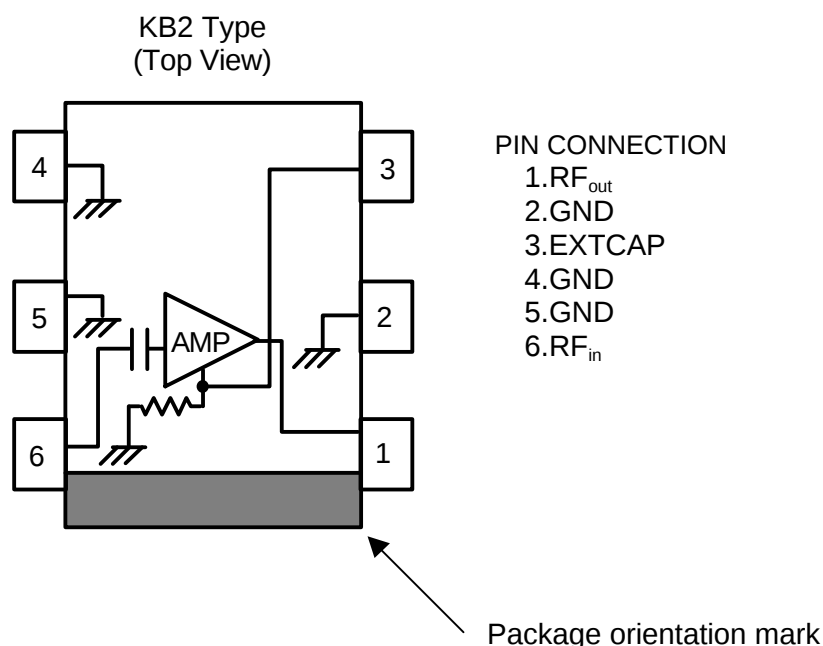


NJG1106KB2

■FEATURES

- | | |
|-----------------------------------|--------------------------------------|
| ●Low voltage operation | +2.7V typ. |
| ●Low current consumption | 2.5mA typ. |
| ●Small signal gain | 17dB typ. @f=820MHz |
| ●Low noise figure | 1.3dB typ. @f=820MHz |
| ●High Input IP3 | -4dBm typ. @f=820.0+820.1MHz |
| ●High Output IP3 | +13dBm typ. @f=820+820.1MHz |
| ●Ultra small & ultra thin package | FLP6-B2 (Mount Size: 2.1x2.0x0.75mm) |

■PIN CONFIGURATION



Note: Specifications and description listed in this catalog are subject to change without prior notice.

NJG1106KB2

■ABSOLUTE MAXIMUM RATINGS

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

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNITS
Drain Voltage	V_{DD}		6.0	V
Input Power	P_{in}	$V_{DD}=2.7\text{V}$	+15	dBm
Power Dissipation	P_D	$T_j=125^{\circ}\text{C}$, mount on PCB FR4 20X20X0.2mm	450	mW
Operating Temp.	T_{opr}		-40 ~ +85	$^{\circ}\text{C}$
Storage Temp.	T_{stg}		-55 ~ +125	$^{\circ}\text{C}$

■ELECTRICAL CHARACTERISTICS

($V_{DD}=2.7\text{V}$, $f=820\text{MHz}$, $T_a=+25^{\circ}\text{C}$, $Z_s=Z_i=50\Omega$)

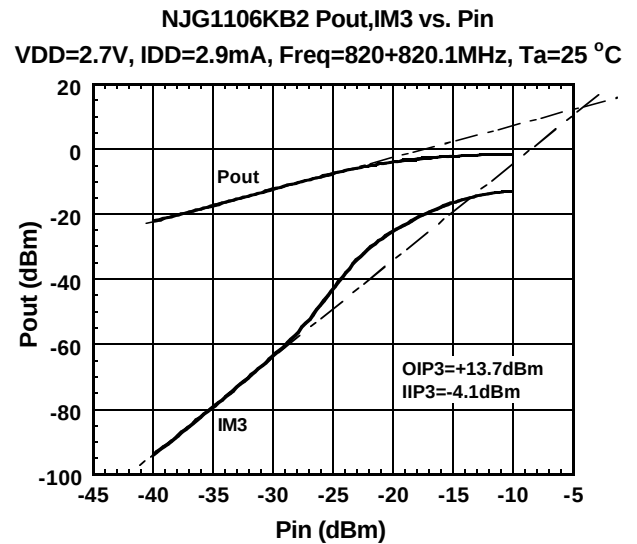
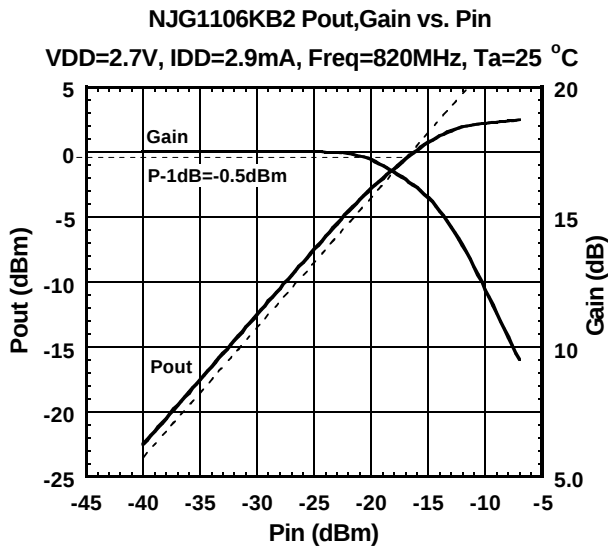
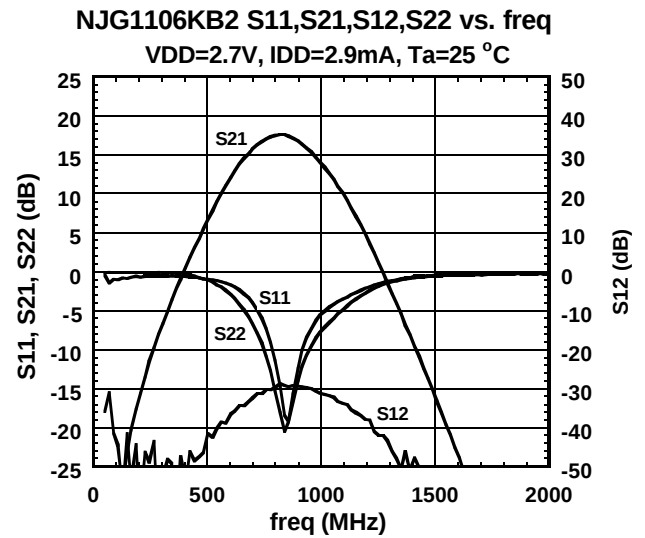
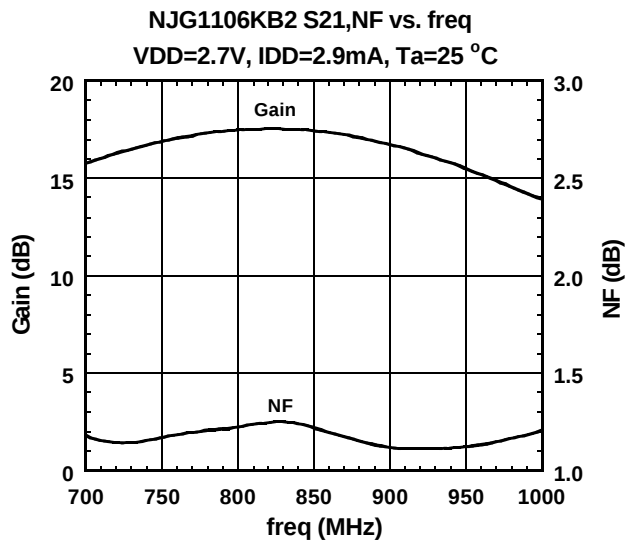
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating frequency	freq		800	820	1000	MHz
Drain voltage	V_{DD}		2.5	2.7	5.5	V
Operating current	I_{DD}	RF OFF	-	2.5	3.4	mA
Small signal gain	Gain		15.0	17.0	19.0	dB
Gain flatness	G_{flat}	$f=810\sim 885\text{MHz}$	-	0.5	1.0	dB
Noise figure	NF		-	1.3	1.5	dB
Pout at 1dB gain compression point	P_{-1dB}	$V_{DD}=2.7\text{V}$, $f=820\text{MHz}$	-4.0	0.0	-	dBm
Input 3rd order Intercept point	IIP3	$f=820.0+820.1\text{MHz}$	-8.0	-4.0	-	dBm
Output 3rd order Intercept point	OIP3	$f=820.0+820.1\text{MHz}$	+9.0	+13.0	-	dBm
RF Input port VSWR	$VSWR_i$	$V_{DD}=2.7\text{V}$, $f=820\text{MHz}$	-	1.5	2.0	
RF Output port VSWR	$VSWR_o$	$V_{DD}=2.7\text{V}$, $f=820\text{MHz}$	-	1.5	2.0	

■ TERMINAL INFORMATION

Pin	Function	Description
1	RFout	RF output and voltage supply pin. External matching circuits and a bypass capacitor is required. L4 is a RF choke inductor and C1 is a DC blocking capacitor. These elements are used as output matching circuit. C2 is a bypass capacitor. (Please refer to "RECOMMENDED CIRCUIT")
2,4,5	GND	Ground pin. To keep good RF grounding performance, please use multiple via holes to connect with ground plane and this pin.
3	EXTCAP	An external bypass capacitor is required. (Please refer to "RECOMMENDED CIRCUIT")
6	RFin	RF input pin. A DC blocking capacitor is not required. An external matching circuit is required. (Please refer to "RECOMMENDED CIRCUIT")

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■ TYPICAL CHARACTERISTICS



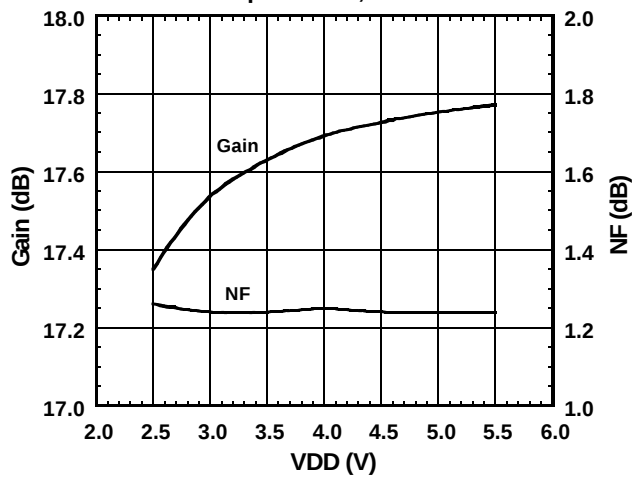
Equations of OIP3 and IIP3

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

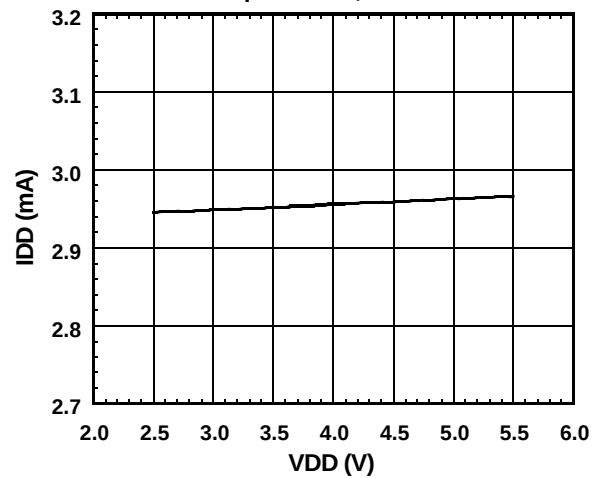
$$\text{IIP3} = \text{OIP3} - \text{Gain} @ \text{Pin} = -40\text{dBm}$$

■ TYPICAL CHARACTERISTICS

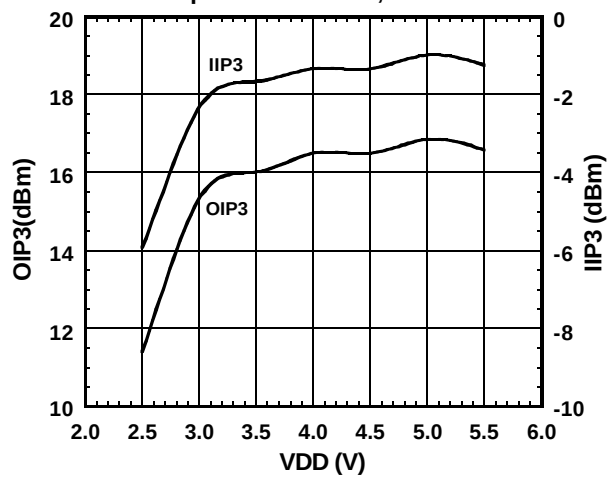
NJG1106KB2 Gain,NF vs. VDD
Freq=820MHz,Ta=25°C



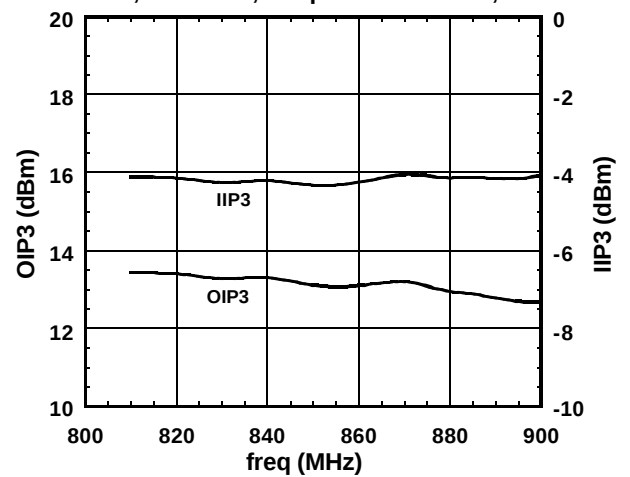
NJG1106KB2 IDD vs. VDD
Freq=820MHz,Ta=25°C



NJG1106KB2 OIP3,IIP3 vs. VDD
Freq=820+820.1MHz, Ta=25°C



NJG1106KB2 OIP3,IIP3 vs. Freq
VDD=2.7V, IDD=3mA, Freq=820+820.1MHz, Ta=25 °C



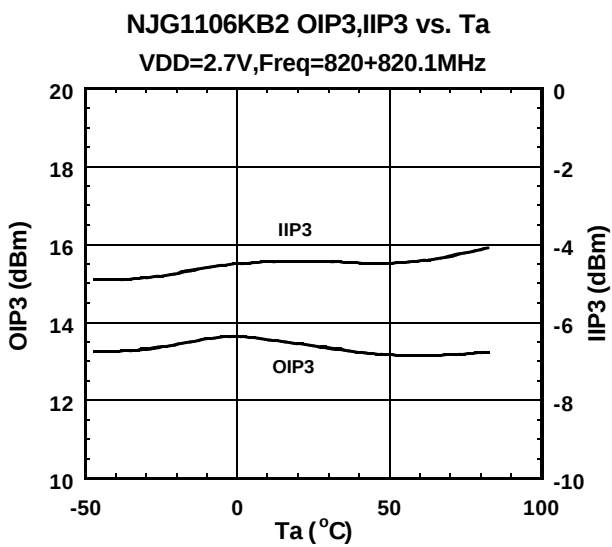
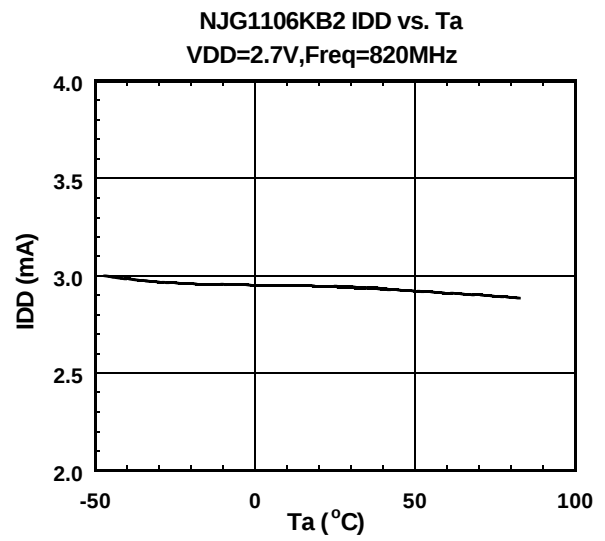
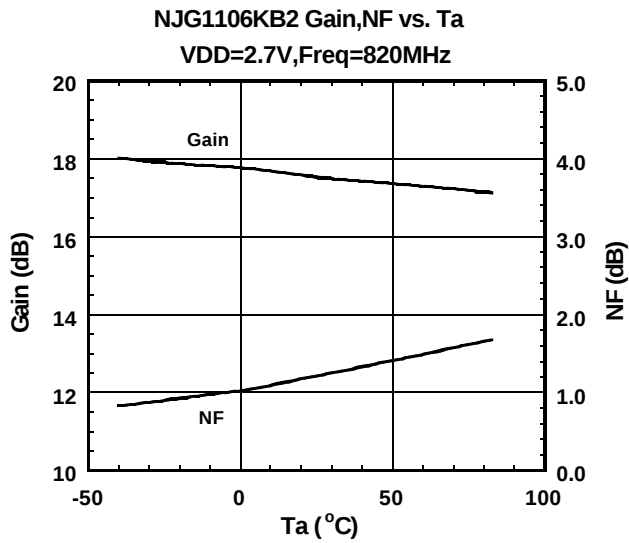
Equations of OIP3 and IIP3

$$OIP3 = \frac{3 \times P_{out} - IM3}{2}$$

$$IIP3 = OIP3 - Gain \text{ @ } P_{in} = -40dBm$$

NJG1106KB2

■ TYPICAL CHARACTERISTICS



Equations of OIP3 and IIP3

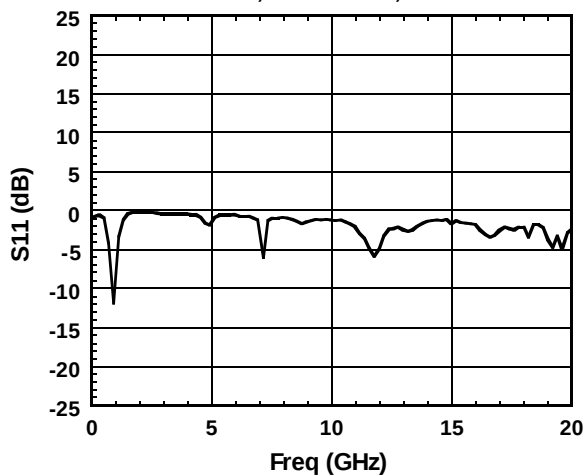
$$OIP3 = \frac{3 \times P_{out} - IM3}{2}$$

$$IIP3 = OIP3 - Gain \text{ @ } P_{in} = -40\text{dBm}$$

■ TYPICAL CHARACTERISTICS

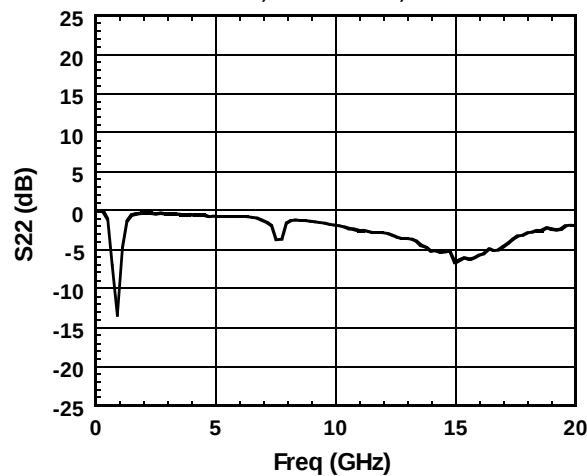
NJG1106KB2 S11 vs. Freq(to 20GHz)

VDD=2.7V, IDD=2.9mA, Ta=25 °C



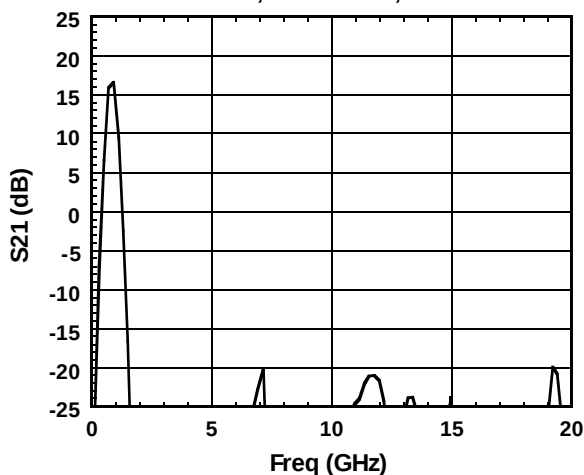
NJG1106KB2 S22 vs. Freq(to 20GHz)

VDD=2.7V, IDD=2.9mA, Ta=25 °C



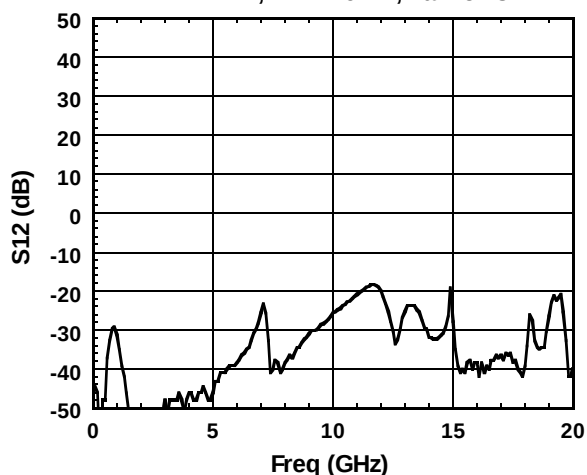
NJG1106KB2 S21 vs. Freq(to 20GHz)

VDD=2.7V, IDD=2.9mA, Ta=25 °C



NJG1106KB2 S12 vs. Freq(to 20GHz)

VDD=2.7V, IDD=2.9mA, Ta=25 °C



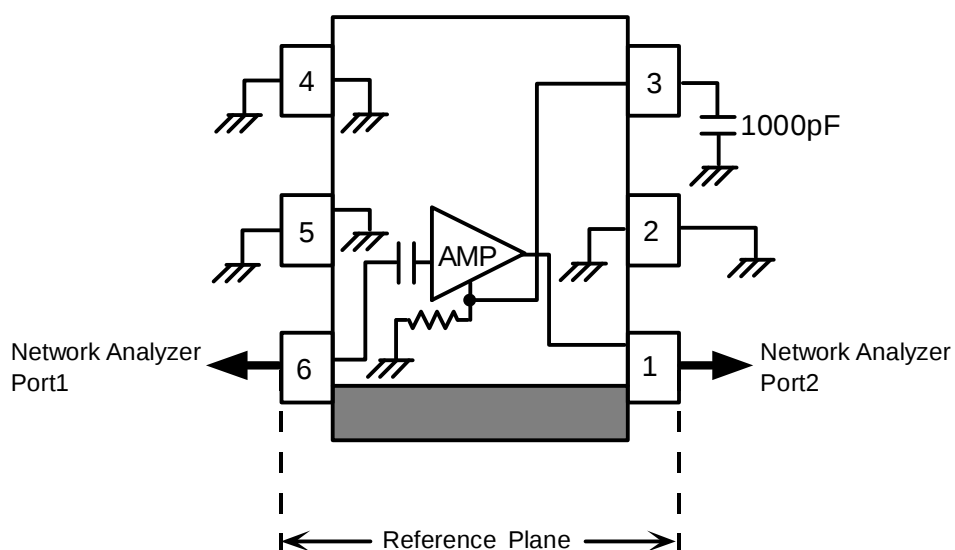
NJG1106KB2

■TYPICAL CHARACTERISTICS

Scattering Parameter Table

$V_{DD}=2.7V$, $I_{DD}=2.9mA$, $Z_0=50\Omega$

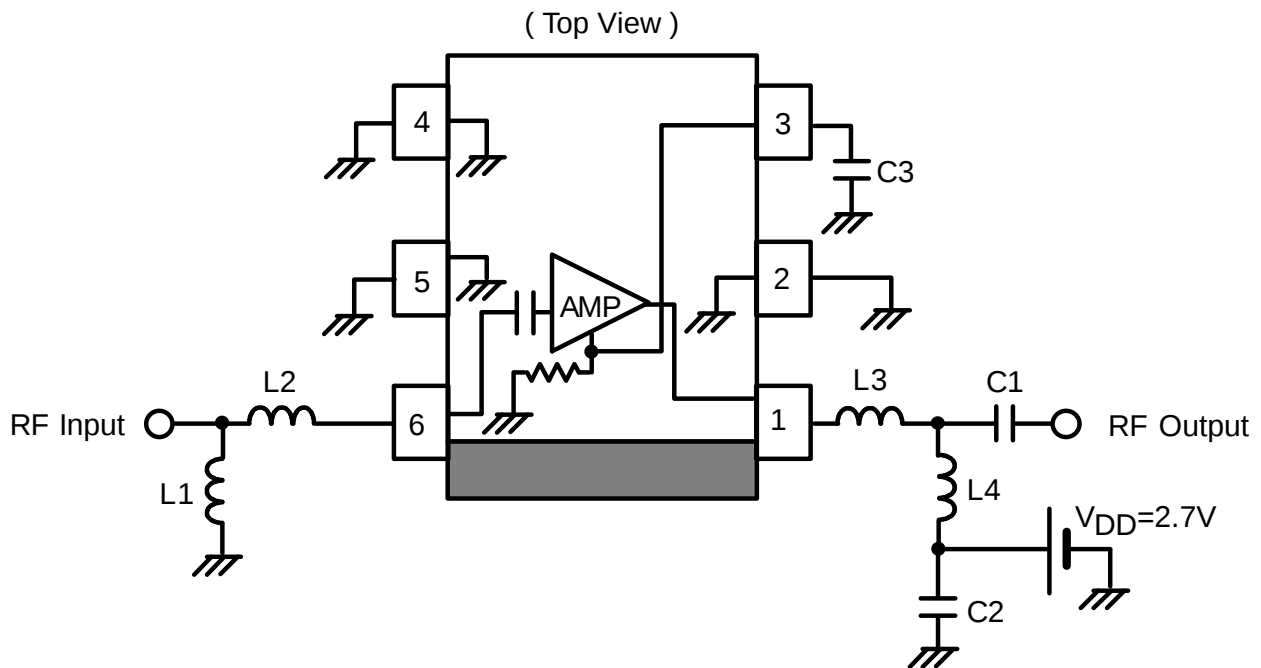
Freq (MHz)	S11		S21		S12		S22	
	mag (units)	ang (deg)	mag (units)	ang (deg)	mag (units)	ang (deg)	mag (units)	ang (deg)
100	0.996	-1.8	1.298	-142.2	0.005	70.0	0.967	-2.3
200	0.995	-4.8	1.846	-164.1	0.003	-6.6	0.953	-3.7
300	0.993	-7.2	2.029	179.1	0.006	38.5	0.942	-4.9
400	0.982	-9.6	2.056	165.7	0.006	36.0	0.939	-6.1
500	0.964	-11.7	2.029	155.1	0.007	47.8	0.931	-7.3
600	0.947	-13.9	1.964	145.6	0.006	54.7	0.928	-8.5
700	0.930	-15.5	1.892	137.5	0.008	55.8	0.918	-9.7
800	0.914	-17.3	1.816	130.0	0.008	60.4	0.916	-10.9
900	0.897	-18.7	1.733	123.2	0.009	62.5	0.906	-12.2
1000	0.884	-20.2	1.659	117.0	0.009	61.0	0.903	-13.4
1100	0.874	-21.5	1.582	111.1	0.010	69.4	0.898	-14.7
1200	0.860	-22.6	1.513	105.8	0.011	70.7	0.893	-16.1
1300	0.851	-23.8	1.449	100.7	0.012	72.6	0.886	-17.3
1400	0.838	-24.9	1.385	96.1	0.012	80.1	0.883	-18.9
1500	0.831	-26.1	1.330	91.4	0.014	77.4	0.878	-20.0
1600	0.822	-27.0	1.279	87.0	0.014	84.4	0.874	-21.3
1700	0.815	-28.2	1.235	83.0	0.016	85.1	0.871	-22.7
1800	0.809	-29.7	1.194	78.9	0.017	90.7	0.869	-24.1
1900	0.803	-30.6	1.153	75.2	0.018	87.7	0.865	-25.4
2000	0.796	-31.8	1.120	71.8	0.019	91.9	0.864	-26.8



Note

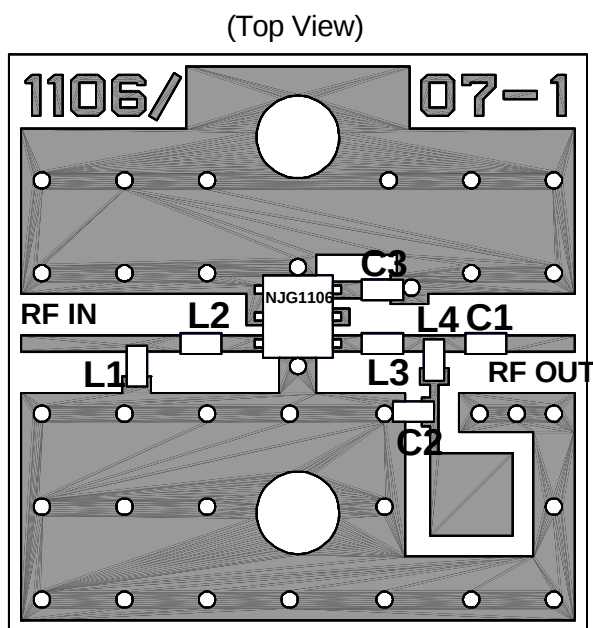
V_{DD} (=2.8V) is supplied through "BIAS CONNECT (PORT2)" of Network Analyzer.

RECOMMENDED CIRCUIT (f=810~885MHz)



NJG1106KB2

RECOMMENDED PCB DESIGN



PCB SIZE: 14.0x14.0mm

PCB: FR4, t=0.2mm

MICROSTRIP LINE WIDTH=0.4mm($Z_0=50\Omega$)

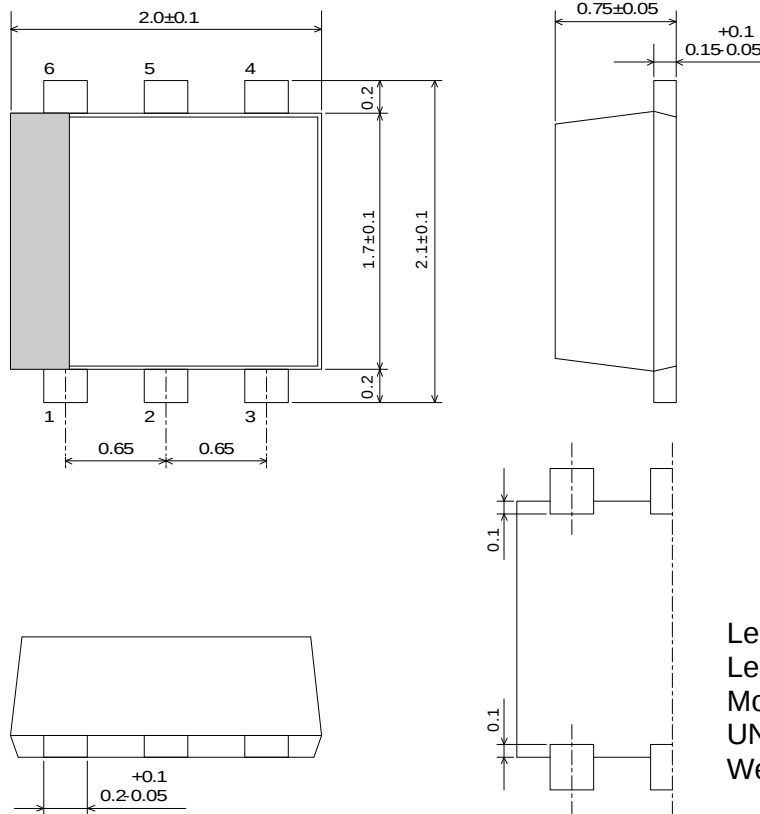
Parts List (f=810~885MHz)

Parts ID	Constant	Comment
L1	82nH	TAIYO-YUDEN HK1005 Series
L2	33nH	TAIYO-YUDEN HK1608 Series
L3	39nH	TAIYO-YUDEN HK1005 Series
L4	12nH	TAIYO-YUDEN HK1005 Series
C1	4pF	MURATA GRM36 Series
C2, C3	1000pF	MURATA GRM36 Series

NOTES:

1. Please use L1 to stabilize amplifier. This element pull input impedance down at low frequency region (up to 400MHz).
2. Please use chip inductor which has low resistance at input circuit. (A low resistance inductor of 1608 size (1.6mm x 0.8mm) is used in the circuit example above.) Because any losses at input circuit cause NF degradation.
3. The capacitor C3 is a bypass capacitor connected with self-biasing resistor. The small signal gain can be controlled by this capacitor. (Gain=18.5dB @ C3=30pF)

■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.

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

[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.