GNSS LOW NOISE AMPLIFIER GaAs MMIC

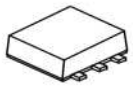
■ GENERAL DESCRIPTION

NJG1130KA1 is a low noise amplifier GaAs MMIC designed for GNSS (Global Navigation Satellite Systems). The LNA offers excellent low noise figure, high linearity and low current consumption.

Two stage amplifier and ESD protection circuit are integrated in the IC to achieve very high gain and high ESD tolerance.

An ultra-small and ultra-thin package of FLP6-A1 is adopted.

■ PACKAGE OUTLINE



NJG1130KA1

■ APPLICATIONS

GNSS applications, like GPS, Galileo, GLONASS and COMPASS
PND (Personal Navigation Device), Car Navigation, Tablet PC, Mobile Phone, and others mobile device applications
GPS L2 Band application

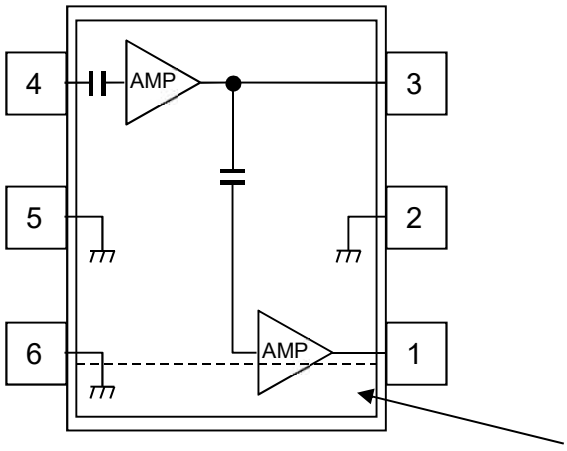
Note: For GPS L2 Band application please refer to Application Note

■ FEATURES

● Low voltage operation	+2.85V typ.
● Low current consumption	5.0mA typ.
● High gain	29.0dB typ. @ f=1575MHz
● Low noise figure	0.65dB typ. @ f=1575MHz
● 1dB gain compression output power	+11.0dBm typ. @ f=1575MHz
● High output IP3	+14dBm typ. @ f=1575+1575.1MHz, Pin=-35dBm
● Ultra-small & ultra-thin package	FLP6-A1 (Package size: 1.6 x 1.6 x 0.6mm)

■ PIN CONFIGURATION

(Top View)



Pin Connection

1. RF OUT
2. GND
3. VDD
4. RF IN
5. GND
6. GND

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

■ ABSOLUTE MAXIMUM RATINGS

T_a=+25°C, Z_s=Z_l=50Ω

PARAMETERS	SYMBOL	CONDITIONS	RATINGS	UNITS
Drain Voltage	V_{DD}		5.0	V
Input power	Pin	V_{DD}=2.85V	+15	dBm
Power dissipation	P_D	on PCB board, at Tjmax=150°C	170	mW
Operating temperature	T_{opr}		-40~+85	°C
Storage temperature	T_{stg}		-55~+150	°C

■ ELECTRICAL CHARACTERISTICS

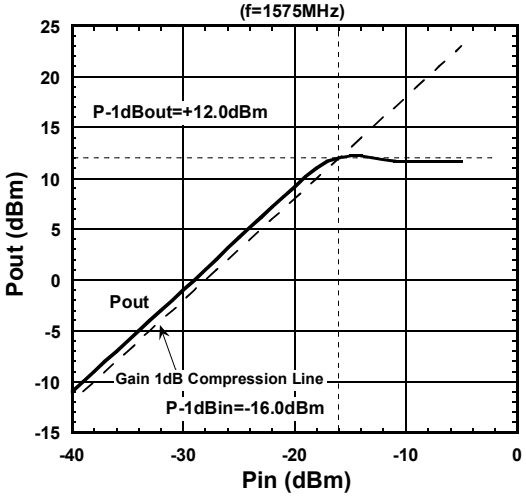
GENERAL CONDITIONS: V_{DD}=2.85V, f_{RF}=1575MHz, T_a=+25°C, Z_s=Z_l=50Ω, with application circuit

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating voltage	V_{DD}		2.5	2.85	3.3	V
Operating current	I_{DD}	RF OFF	-	5.0	8.5	mA
Small signal gain	Gain		26.0	29.0	31.5	dB
Noise figure	NF	Exclude PCB & connector losses (0.10dB)	-	0.65	0.95	dB
1dB gain compression output power	$P_{-1dB(out)}$		+5.0	+11.0	-	dBm
3rd order output intercept point	OIP3	f1=f_{RF}, f2=f1+100kHz, Pin=-35dBm	+7.0	+14.0	-	dBm
RF IN VSWR	VSWRi		-	2.4	2.8	
RF OUT VSWR	VSWRo		-	1.6	2.0	

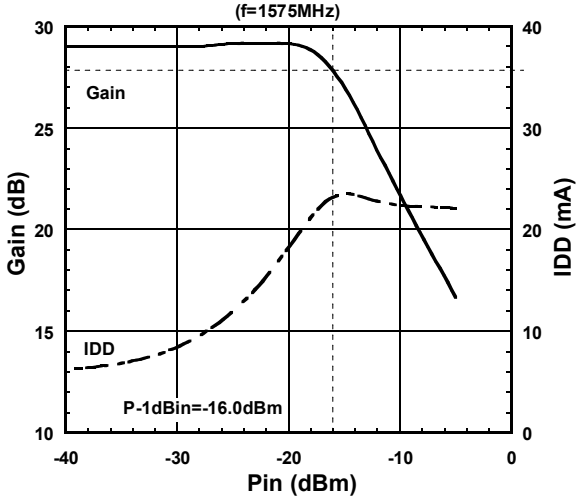
■ ELECTRICAL CHARACTERISTICS

(Condition: Ta=+25°C, V_{DD}=2.85V, Zs=Zl=50Ω with application circuit)

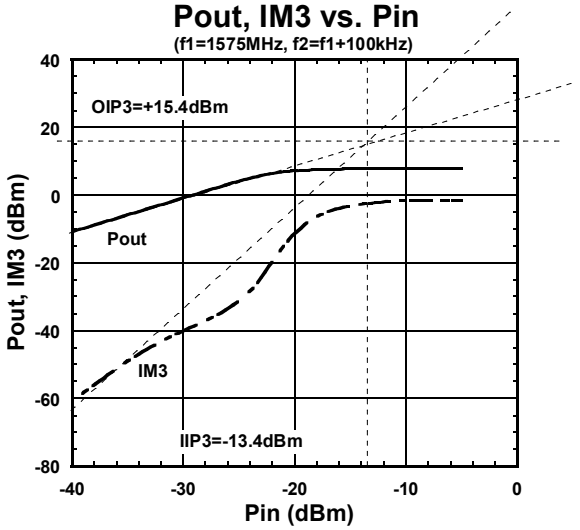
Pout vs. Pin



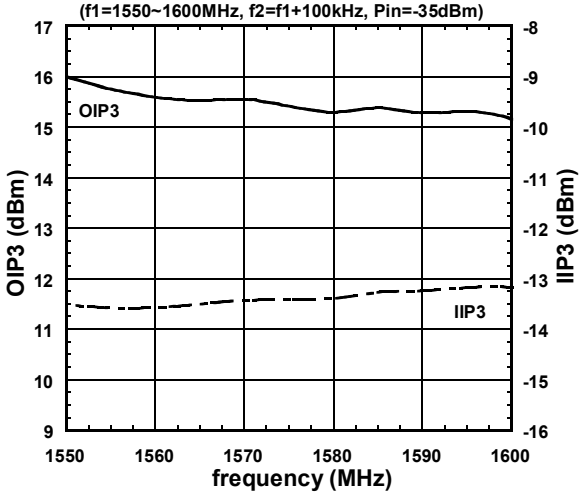
Gain, IDD vs. Pin



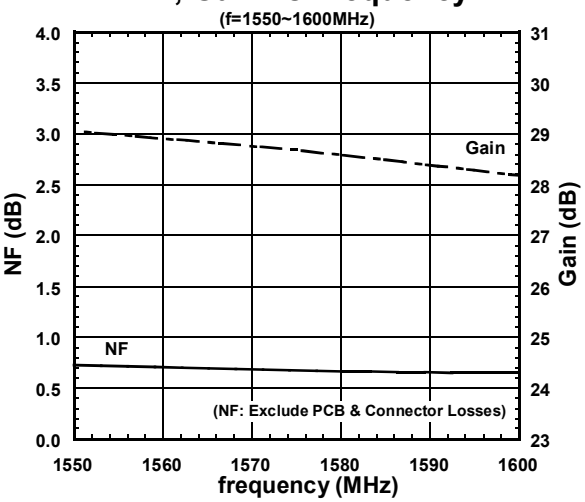
Pout, IM3 vs. Pin



OIP3, IIP3 vs. frequency



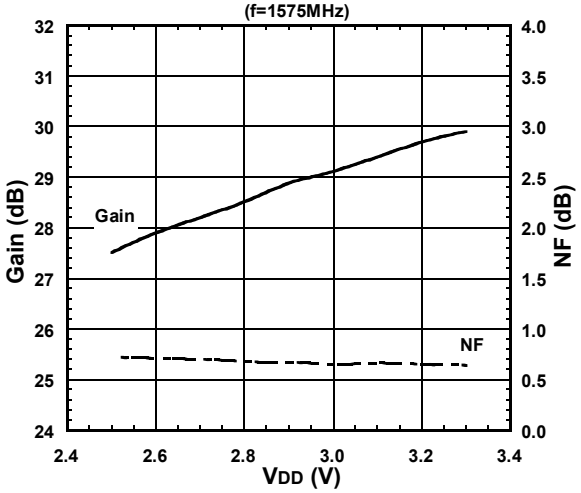
NF, Gain vs. frequency



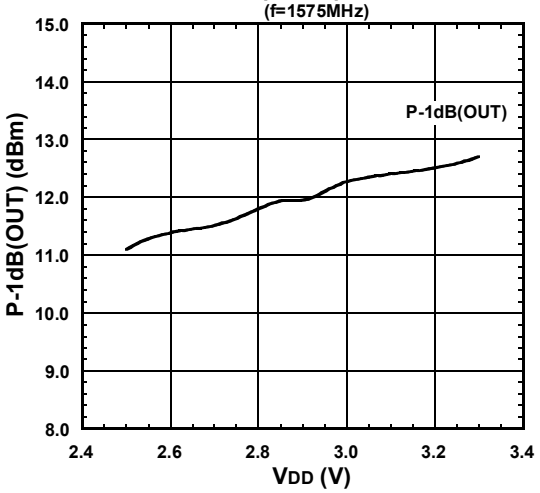
■ ELECTRICAL CHARACTERISTICS

(Condition: Ta=+25°C, Zs=Zl=50Ω with application circuit)

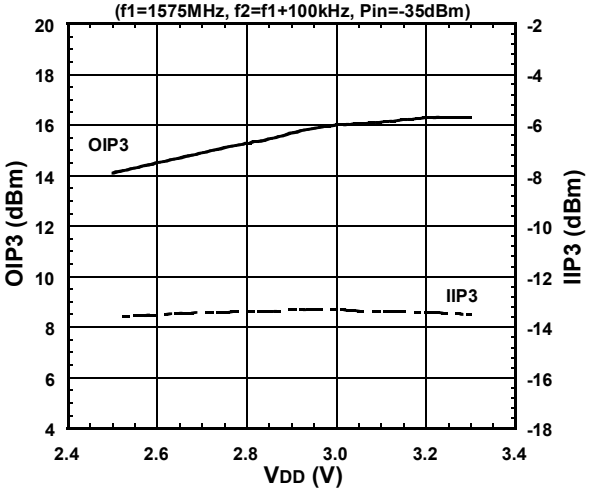
Gain, NF vs. VDD



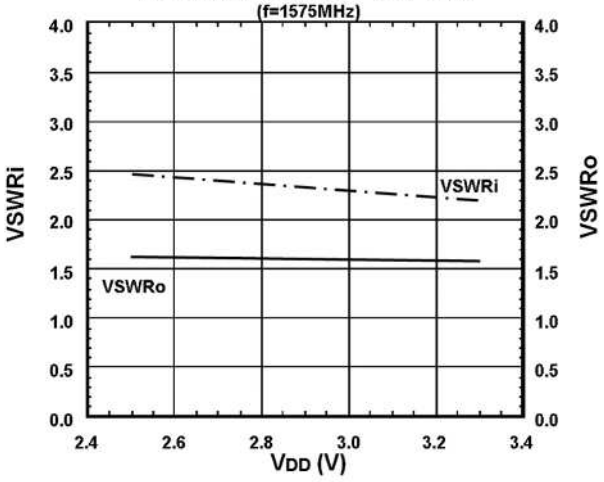
P-1dB(OUT) vs. VDD



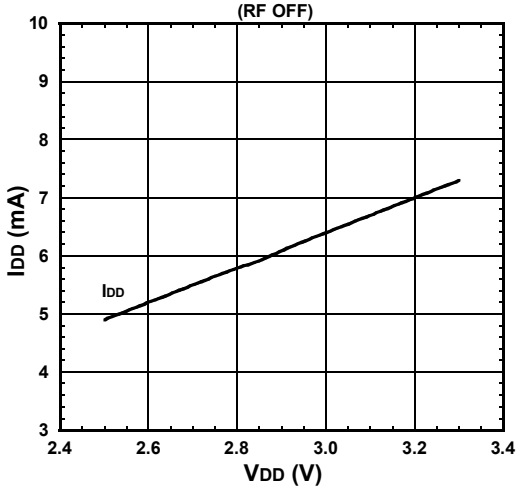
OIP3, IIP3 vs. VDD



VSWRi, VSWRo vs. VDD



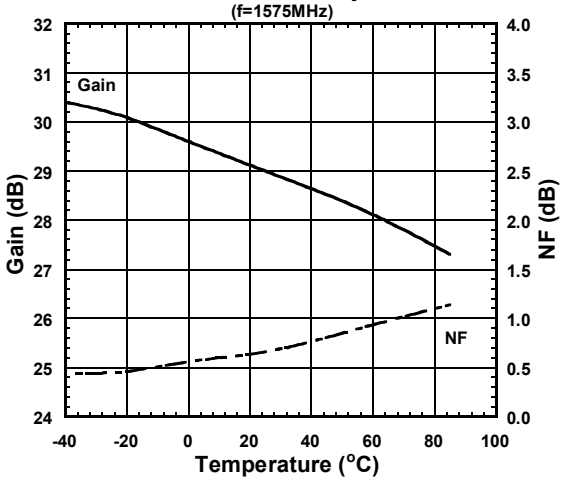
IDD vs. VDD



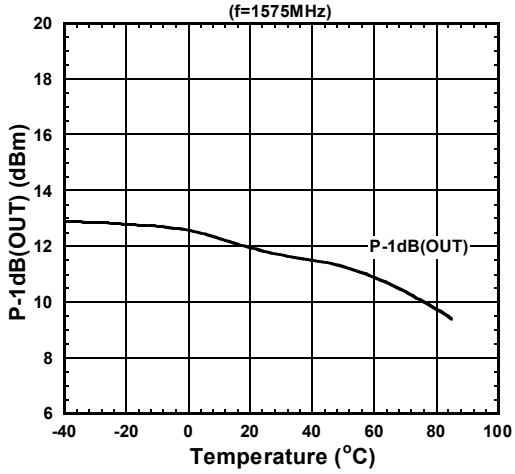
■ ELECTRICAL CHARACTERISTICS

(Condition: V_{DD}=2.85V, Zs=Zl=50Ω with application circuit)

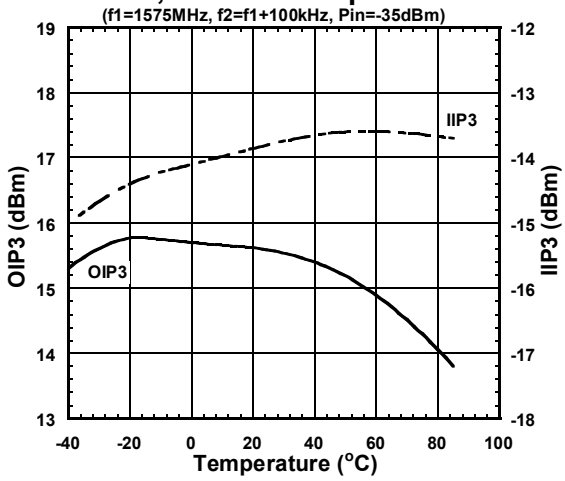
Gain, NF vs. Temperature



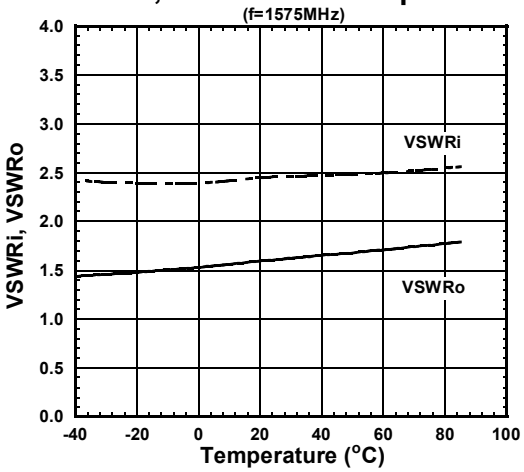
P-1dB(OUT) vs. Temperature



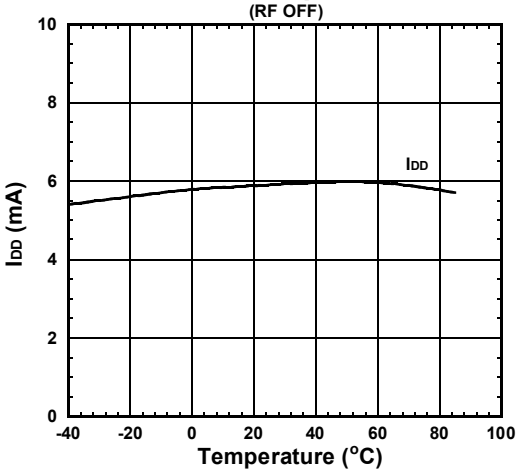
OIP3, IIP3 vs. Temperature



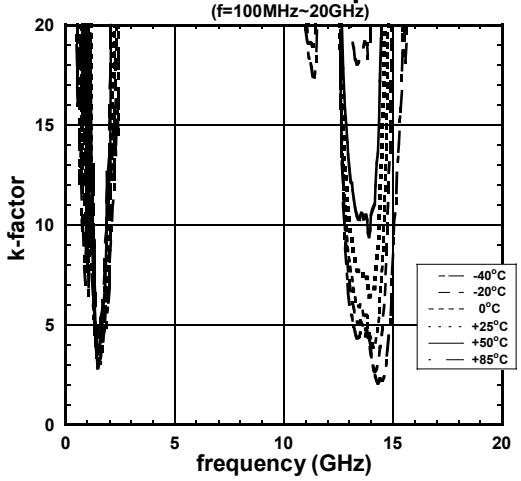
VSWRi, VSWRo vs. Temperature



I_{DD} vs. Temperature

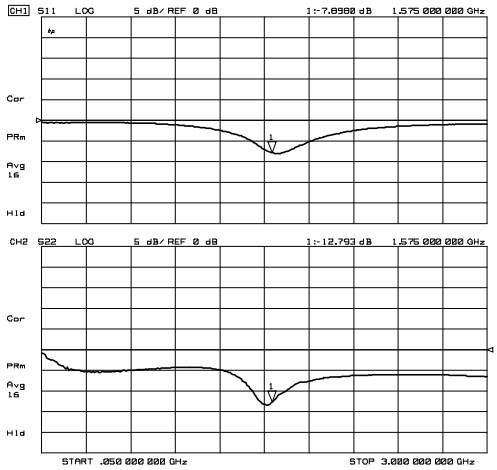


k-factor vs. Temperature

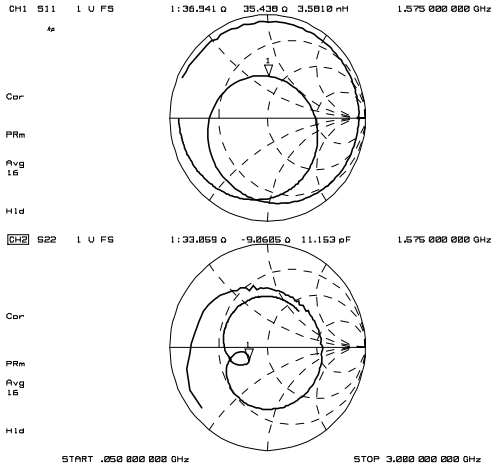


■ ELECTRICAL CHARACTERISTICS

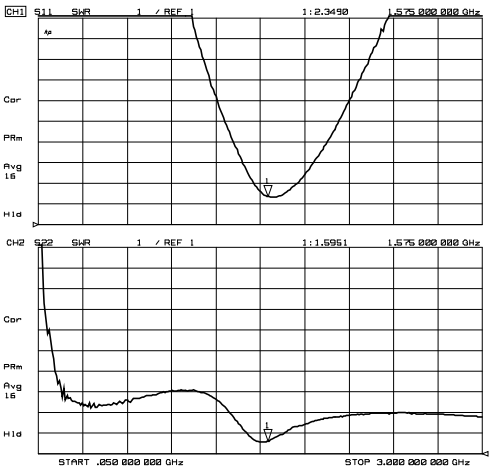
(Condition: Ta=+25°C, V_{DD}=2.85V, Zs=Zl=50Ω with application circuit)



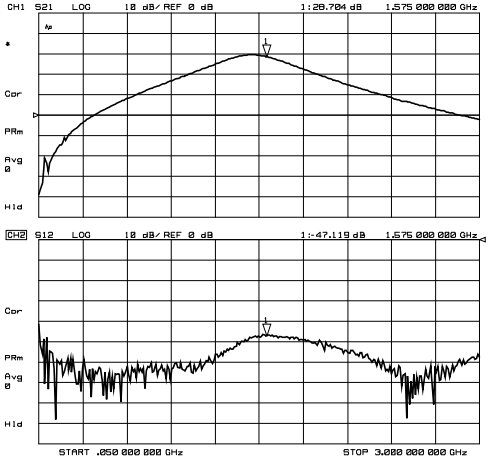
S11, S22



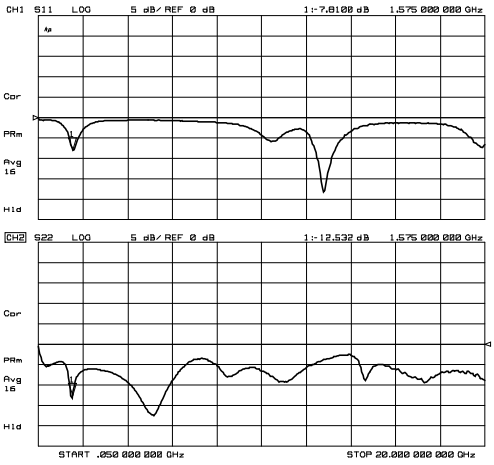
Zin, Zout



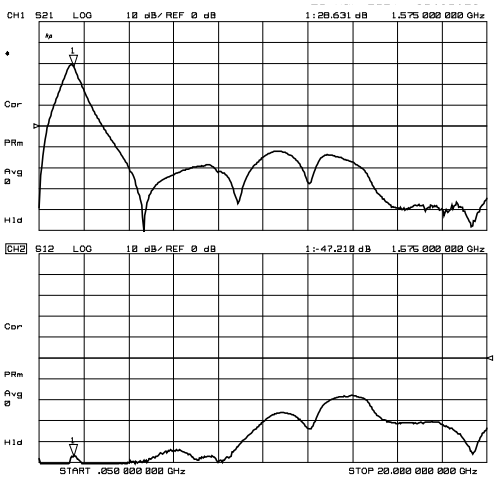
VSWR



S21, S12

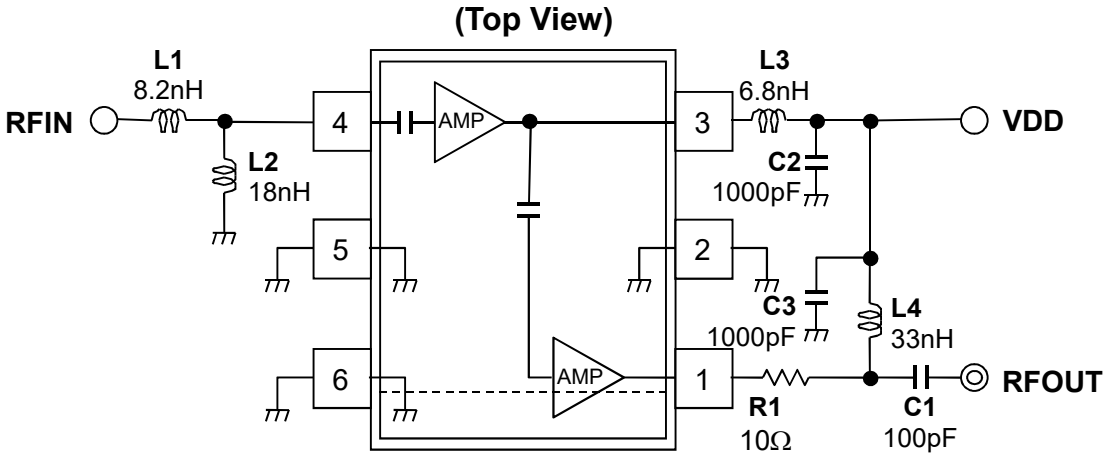


S11, S22 (~20GHz)



S21, S12 (~20GHz)

■ APPLICATION CIRCUIT

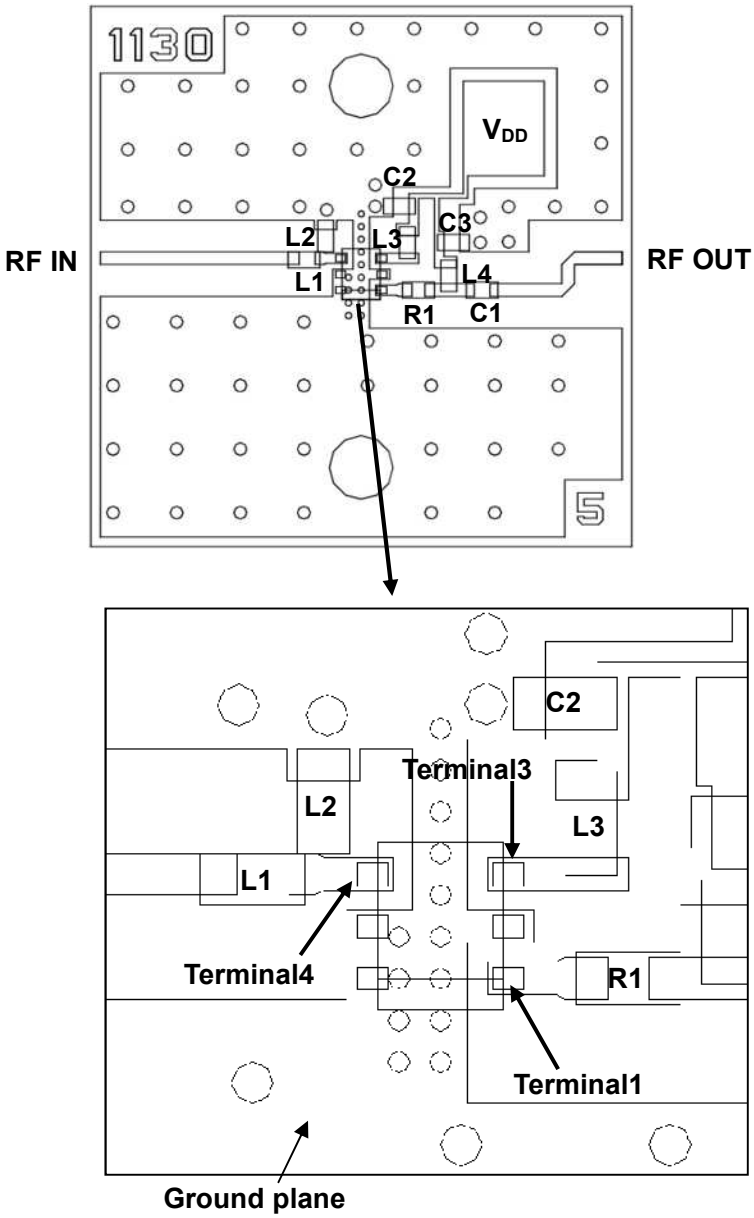


NOTES:

- L1 and L2 form the input matching circuit. The LNA has integrated coupling and DC-blocking capacitor at the input.
- L3 is a matching inductor of the integrated 1st amplifier and 2nd amplifier. It should be connected to the terminal3 as close as possible.
- L4 is an output matching inductor.
- C1 is a coupling and DC-blocking capacitor at the output.
- C2 and C3 are bypass capacitors. They should be connected between L3 and L4. C2 should be placed to the side of L3, and C3 should be placed to the side of L4, and should not be directly connected L3 and L4.
- R1 is a stability resistor at high frequency, and it should be connected to the terminal1.
- Ground terminal (No.2, 5, 6) should be connected to the ground plane as close as possible for good RF performance.
- For good performance, the terminal1,3 and 4 should not be coupled though floating-capacitance which exists between RF transmission lines.

■ TEST PCB LAYOUT

(Top View)



■Parts List

Parts ID	Commment
L1 to L4	TAIYO-YUDEN HK1005 Series
C1 to C3	MURATA GRM15 Series
R1	1005 Size

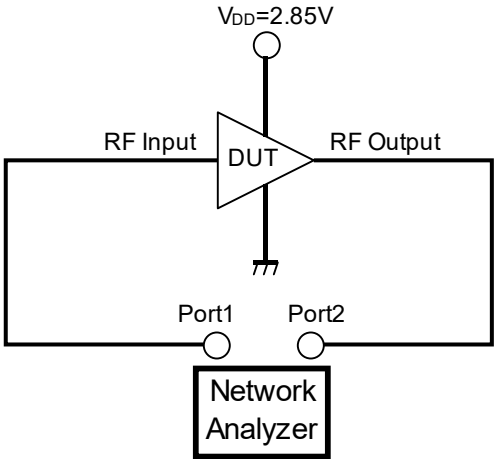
PCB (FR-4):
t=0.2mm
MICROSTRIP LINE WIDTH
=0.4mm (Z_0=50Ω)
PCB SIZE
=17.0mm × 17.0mm

PRECAUTION:

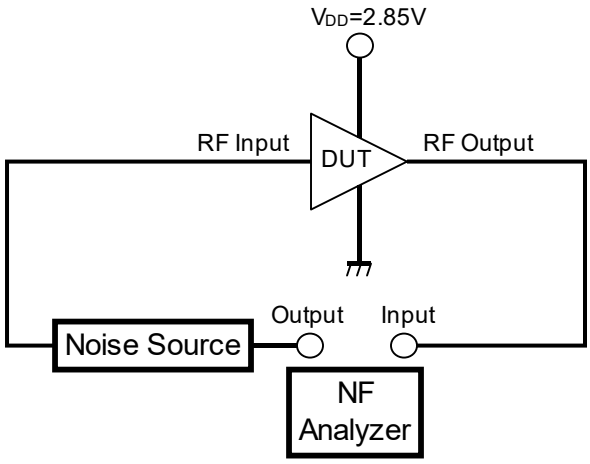
[1] For good performance, the terminal1, 3 and 4 should not be coupled though floating-capacitance which exists between RF transmission lines.
[2] In order not to couple with terminal 1, 3 and 4, please layout ground pattern under the IC.
[3] C2 should be placed to the side of L3, and C3 should be placed the side of L4. They should be connect between L3 and L4, should not be directly connected L3 and L4.

■ TEST CIRCUITS

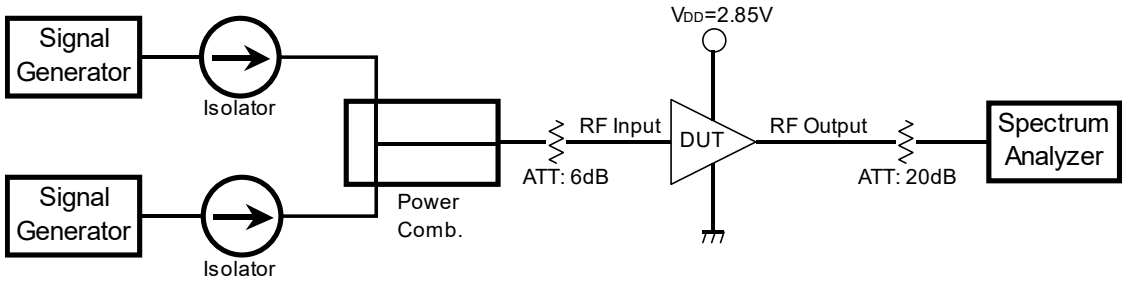
Test Circuits 1 to 3 define the test conditions used in the product electrical characteristics table.



Test Circuit 1. S-Parameter

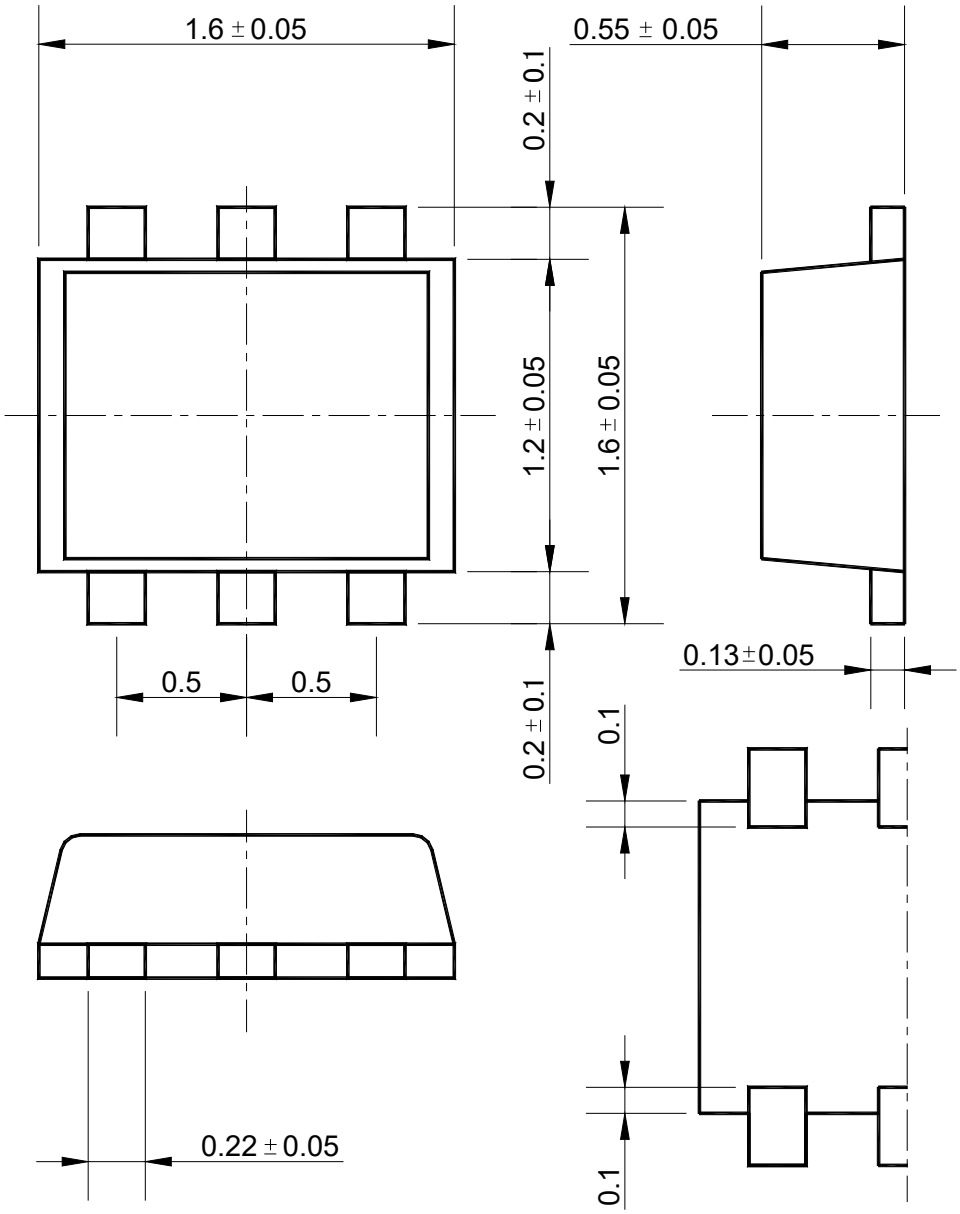


Test Circuit 2. NF



Test Circuit 3. Third order output intercept point

■ PACKAGE OUTLINE (FLP6-A1)



UNIT: mm

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.

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    - Aerospace Equipment
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    - Power Generator Control Equipment (nuclear, steam, hydraulic, etc.)
    - Life Maintenance Medical Equipment
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    - Vehicle Control Equipment (automotive, airplane, railroad, ship, etc.)
    - Various Safety Devices
    - Traffic control system
    - Combustion equipment

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6. We are making our continuous effort to improve the quality and reliability of our products, but semiconductor products are likely to fail with certain probability. In order to prevent any injury to persons or damages to property resulting from such failure, customers should be careful enough to incorporate safety measures in their design, such as redundancy feature, fire containment feature and fail-safe feature. We do not assume any liability or responsibility for any loss or damage arising from misuse or inappropriate use of the products.
7. The products have been designed and tested to function within controlled environmental conditions. Do not use products under conditions that deviate from methods or applications specified in this datasheet. Failure to employ the products in the proper applications can lead to deterioration, destruction or failure of the products. We shall not be responsible for any bodily injury, fires or accident, property damage or any consequential damages resulting from misuse or misapplication of the products.
8. Quality Warranty
    8-1. Quality Warranty Period
    In the case of a product purchased through an authorized distributor or directly from us, the warranty period for this product shall be one (1) year after delivery to your company. For defective products that occurred during this period, we will take the quality warranty measures described in section 8-2. However, if there is an agreement on the warranty period in the basic transaction agreement, quality assurance agreement, delivery specifications, etc., it shall be followed.
    8-2. Quality Warranty Remedies
    When it has been proved defective due to manufacturing factors as a result of defect analysis by us, we will either deliver a substitute for the defective product or refund the purchase price of the defective product.
    Note that such delivery or refund is sole and exclusive remedies to your company for the defective product.
    8-3. Remedies after Quality Warranty Period
    With respect to any defect of this product found after the quality warranty period, the defect will be analyzed by us. On the basis of the defect analysis results, the scope and amounts of damage shall be determined by mutual agreement of both parties. Then we will deal with upper limit in Section 8-2. This provision is not intended to limit any legal rights of your company.
9. Anti-radiation design is not implemented in the products described in this document.
10. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
11. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
12. Warning for handling Gallium and Arsenic (GaAs) products (Applying to GaAs MMIC, Photo Reflector). These products use Gallium (Ga) and Arsenic (As) which are specified as poisonous chemicals by law. For the prevention of a hazard, do not burn, destroy, or process chemically to make them as gas or power. When the product is disposed of, please follow the related regulation and do not mix this with general industrial waste or household waste.
13. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.

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