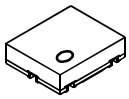
GNSS LOW NOISE AMPLIFIER

■ GENERAL DESCRIPTION

The NJG1108HA8 is a low noise amplifier GaAs MMIC designed for GNSS (Global Navigation Satellite Systems). This amplifier provides low noise figure, high gain and high IP3 operated by single low positive power supply. This IC has the function of Stand-by mode. The NJG1108HA8 can be tuned to wide frequency from 1.5GHz to 2.7GHz by changing the external matching components.

An ultra-small and ultra-thin package of the USB6-A8 is adopted.

■ PACKAGE OUTLINE



NJG1108HA8

■ APPLICATIONS

GNSS application, like GPS,Galileo,GLONASS and COMPASS
W-LAN and WiMAX application

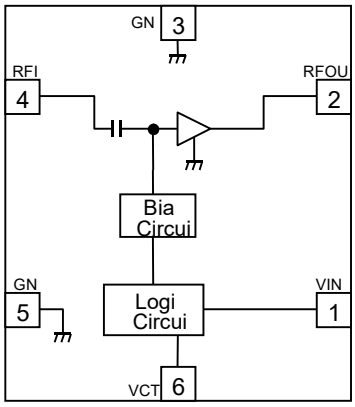
Note: Please check the Application Note for WLAN and WiMAX .

■ FEATURES

● Operating frequency range	1.5~2.7GHz	
● Low voltage operation	+2.7V typ.	
● Low current consumption	2.0mA typ.	@V_{CTL}=1.85V
	1uA typ.	@V_{CTL}=0V
● High gain	19dB typ.	@V_{CTL}=1.85V, f=1.575GHz
● Low noise figure	1.0dB typ.	@V_{CTL}=1.85V, f=1.575GHz
● Input power at 1dB gain compression point	-15.0dBm typ.	@V_{CTL}=1.85V, f=1.575GHz
● High input IP3	0dBm typ.	@V_{CTL}=1.85V, f=1.575+1.5751GHz
● Ultra-small and ultra-thin package	USB6-A8 (Package size: 1.0x1.2x0.38mm)	

■ PIN CONFIGURATION

(Top View)



Pin Connection
1. VINV
2. RFOUT
3. GND
4. RFIN
5. GND
6. VCTL

■TRUTH TABLE

"H"=$V_{CTL(H)}$, "L"=$V_{CTL(L)}$

V_{CTL}	LNA Mode
H	Active Mode
L	Sleep Mode

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=50ohm

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNITS
Drain Voltage	V_{DD}		5.0	V
Inverter voltage	V_{INV}		5.0	V
Control voltage	V_{CTL}		5.0	V
Input power	Pin	V_{DD}=2.7V	+15	dBm
Power dissipation	P_D	On PCB board, Tjmax=150°C	150	mW
Operating temperature	T_{opr}		-40~+85	°C
Storage temperature	T_{stg}		-55~+150	°C

■ELECTRICAL CHARACTERISTICS 1

GENERAL CONDITIONS: V_{DD}=V_{INV}=2.7V, T_a=+25°C, Z_s=Z_l=50ohm, with application circuit

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating voltage	V_{DD}		2.5	2.7	3.5	V
Inverter supply voltage	V_{INV}		2.5	2.7	3.5	V
Control voltage (High)	V_{CTL}(H)		1.5	1.85	V_{INV}+0.3	V
Control voltage (Low)	V_{CTL}(L)		0	0	0.3	V
Operating current1 (Active Mode, RF OFF)	I_{DD}1	RF OFF, V_{CTL}=1.85V	-	2.0	3.0	mA
Operating current2 (Sleep Mode, RF OFF)	I_{DD}2	RF OFF, V_{CTL}=0V	-	1	5	μA
Inverter current1	I_{INV}1	RF OFF, V_{CTL}=1.85V	-	30	60	μA
Inverter current2	I_{INV}2	RF OFF, V_{CTL}=0V	-	9	20	μA
Control current	I_{CTL}	RF OFF, V_{CTL}=1.85V	-	6	20	μA

■**ELECTRICAL CHARACTERISTICS 2** (Active Mode)

GENERAL CONDITIONS: V_{DD}=V_{INV}=2.7V, V_{CTL}=1.85V, f_{RF}=1575MHz, T_a=+25°C, Z_s=Z_l=50ohm, with application circuit

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Frequency	freq		1.57	1.575	1.58	GHz
Small signal gain	Gain		17.0	19.0	21.5	dB
Noise figure	NF	Exclude PCB & connector losses (IN: 0.05dB)	-	1.0	1.2	dB
Input power at 1dB gain compression point	$P_{-1dB(IN)}$		-19.0	-15.0	-	dBm
Input 3rd order intercept point	IIP3	f1=f_{RF}, f2=f_{RF}+100kHz, Pin=-34dBm	-5.0	0	-	dBm
RF IN VSWR	VSWRi		-	2.0	2.5	
RF OUT VSWR	VSWRo		-	1.5	2.0	

■TERMINAL INFORMATION

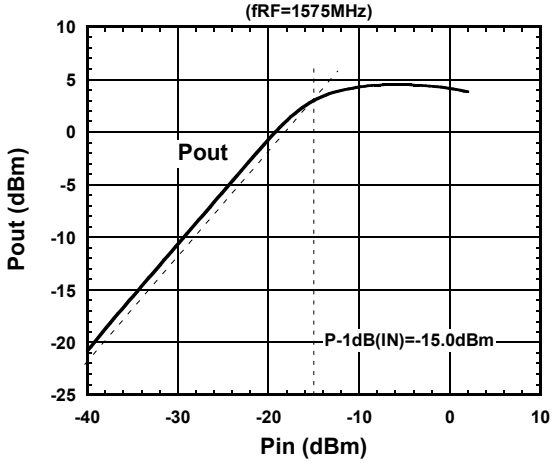
No.	SYMBOL	DESCRIPTION
1	VINV	Power supply pin of the inverter circuit.
2	RFOUT	RF Output and voltage supply pin. External matching circuits and a bypass capacitor is required. L3 is a RF choke inductor. These elements are used as output matching circuit.
3	GND	Ground pin. To keep good RF grounding performance, please use multiple via holes to connect with ground plane and this pin.)
4	RFIN	RF input pin. A DC blocking capacitor is not required. An external matching circuit is required.
5	GND	Ground pin. To keep good RF grounding performance, please use multiple via holes to connect with ground plane and this pin.)
6	VCTL	Control voltage input pin. This control pin is set to high. LNA suffers from standby state when LNA puts the changeover voltage of "Low" in a state of movement when the changeover voltage of "High" is put in this terminal.

CAUTION
1) Ground terminal (3, 5) should be connected to the ground plane as low inductance as possible.

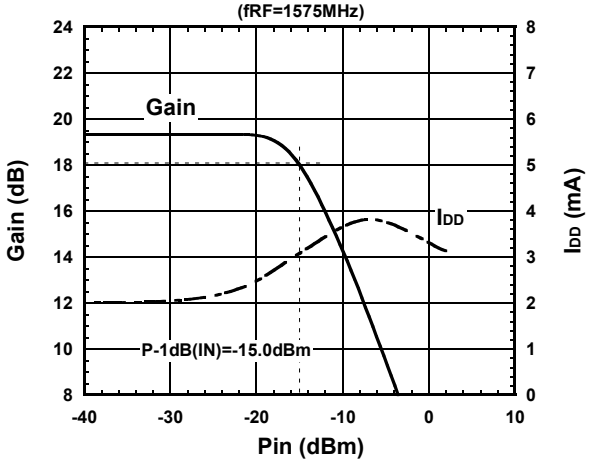
■ ELECTRICAL CHARACTERISTICS

(Conditions: V_{DD}=V_{INV}=2.7V, V_{CTL}=1.85V, f_{RF}=1575MHz, T_a=+25°C, Z_s=Z_l=50ohm, with application circuit)

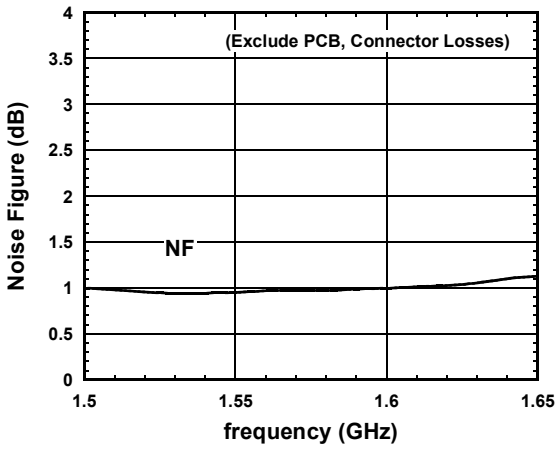
Pout vs. Pin



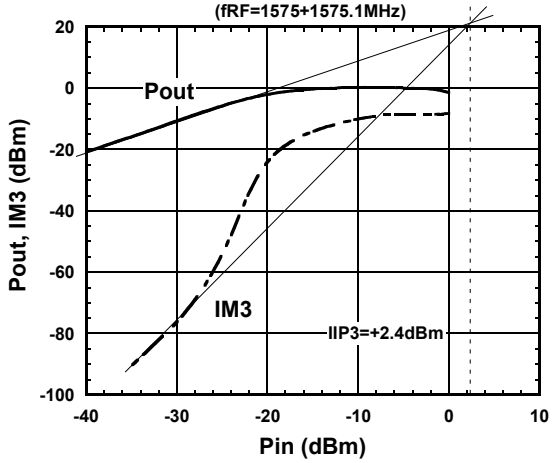
Gain, I_{DD} vs. Pin



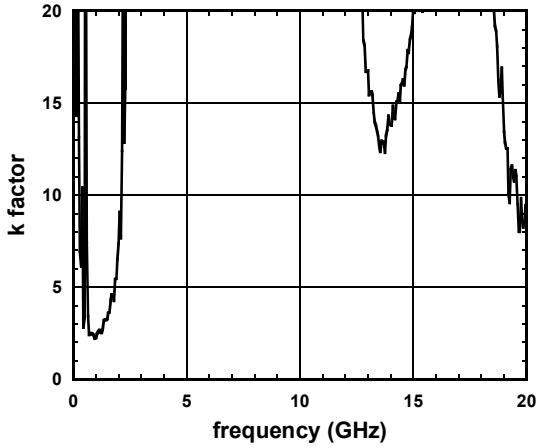
NF vs. frequency



Pout, IM3 vs. Pin



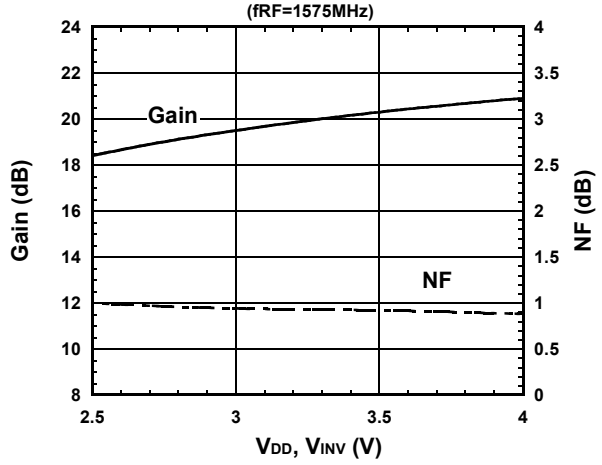
k factor vs. frequency



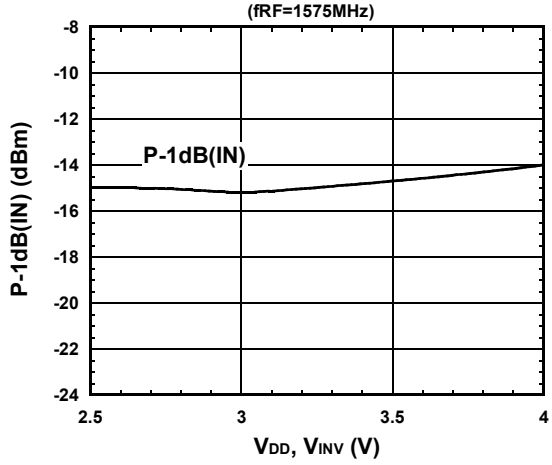
■ ELECTRICAL CHARACTERISTICS

(Conditions: V_{DD}=V_{INV}=2.7V, V_{CTL}=1.85V, f_{RF}=1575MHz, T_a=+25°C, Z_s=Z_l=50ohm, with application circuit)

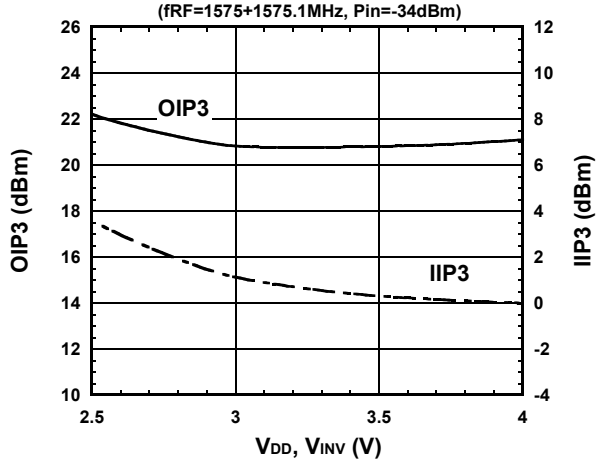
Gain, NF vs. VDD, VINV
(fRF=1575MHz)



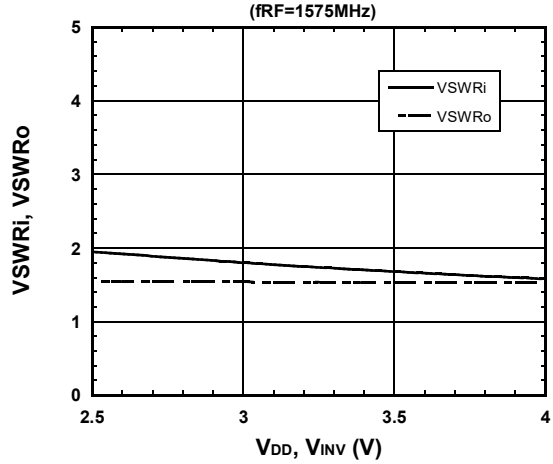
P-1dB(IN) vs. VDD, VINV
(fRF=1575MHz)



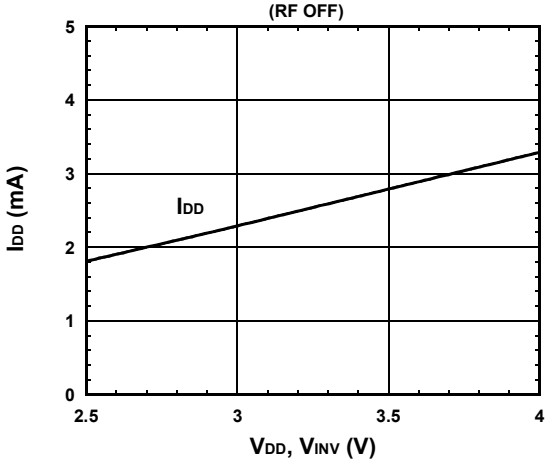
OIP3, IIP3 vs. VDD, VINV
(fRF=1575+1575.1MHz, Pin=-34dBm)



VSWR vs. VDD, VINV
(fRF=1575MHz)



IDD vs. VDD, VINV
(RF OFF)

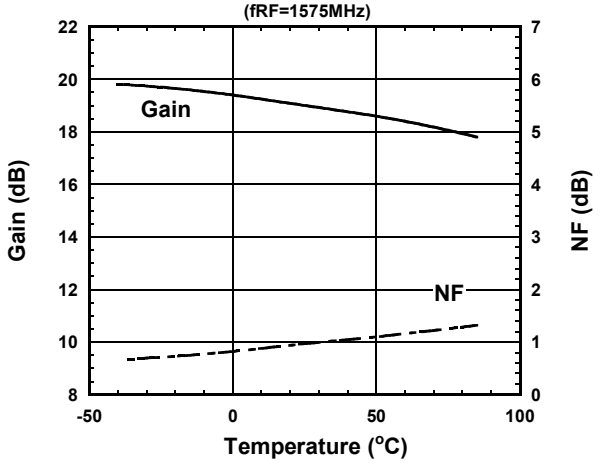


■ ELECTRICAL CHARACTERISTICS

(Conditions: V_{DD}=V_{INV}=2.7V, V_{CTL}=1.85V, f_{RF}=1575MHz, T_a=+25°C, Z_s=Z_l=50ohm, with application circuit)

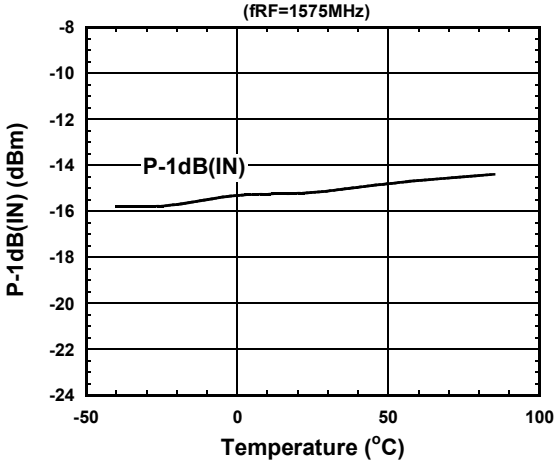
Gain, NF vs. Temperature

(fRF=1575MHz)



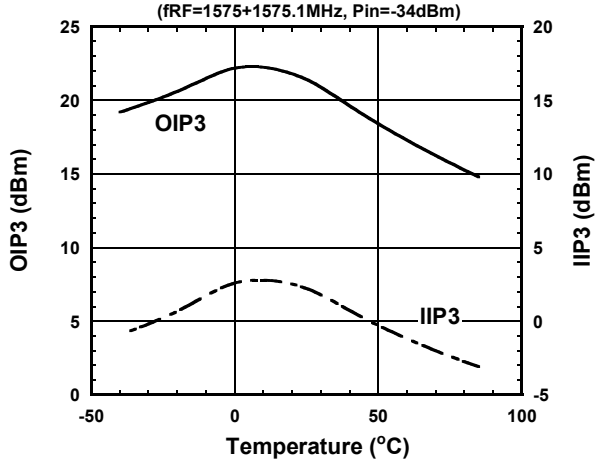
P-1dB(IN) vs. Temperature

(fRF=1575MHz)



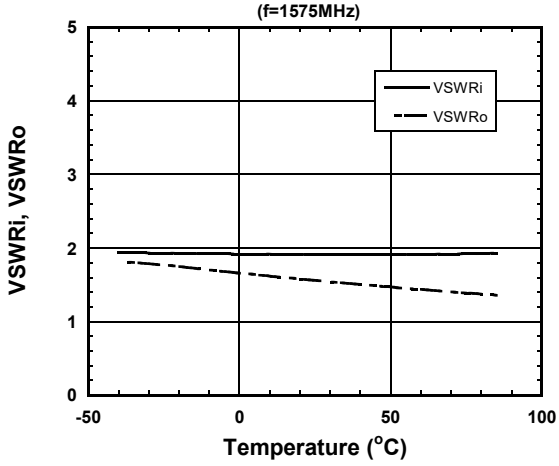
OIP3, IIP3 vs. Temperature

(fRF=1575+1575.1MHz, Pin=-34dBm)



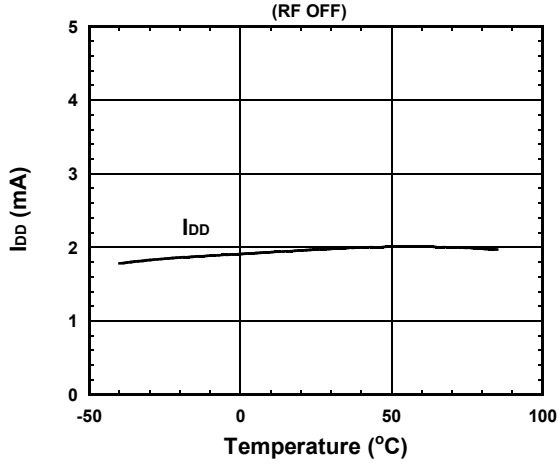
VSWR vs. Temperature

(f=1575MHz)



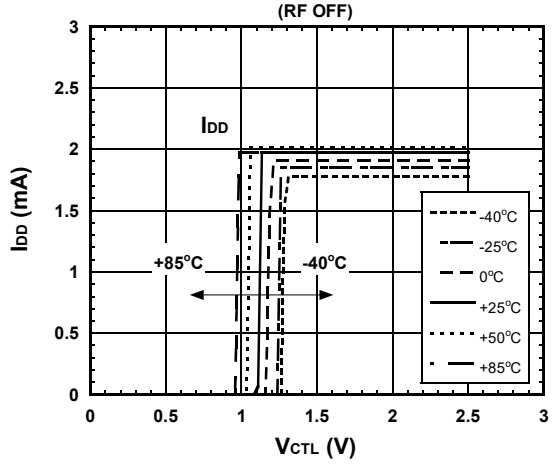
I_{DD} vs. Temperature

(RF OFF)



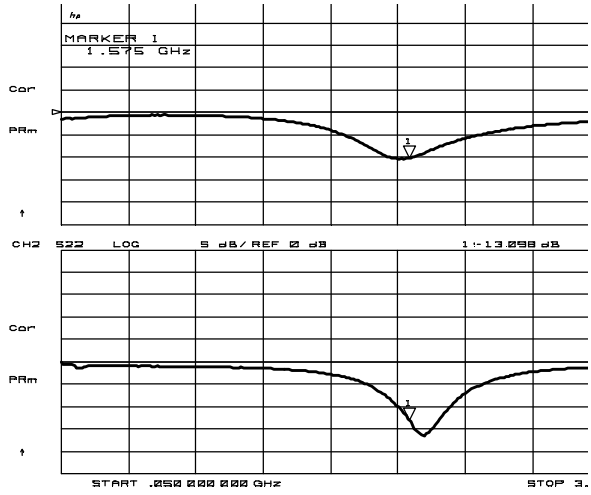
I_{DD} vs. V_{CTL}

(RF OFF)

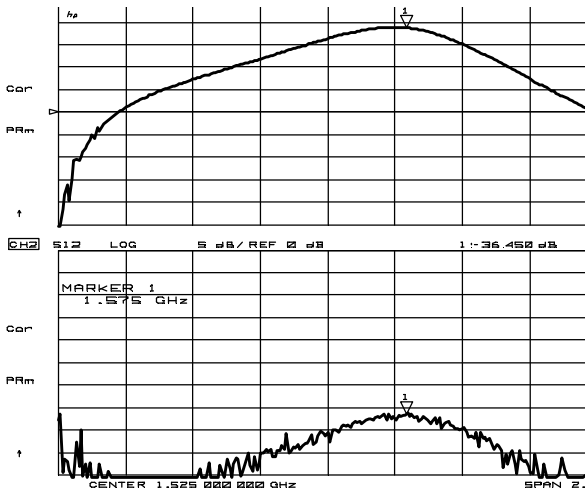


■ ELECTRICAL CHARACTERISTICS

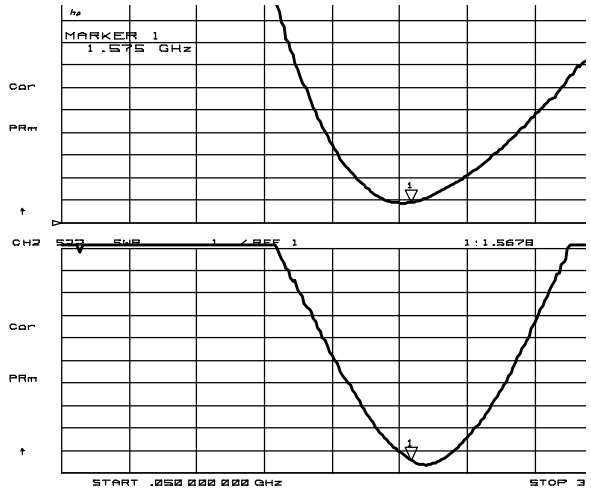
(Conditions: V_{DD}=V_{INV}=2.7V, V_{CTL}=1.85V, f_{RF}=1575MHz, T_a=+25°C, Z_s=Z_l=50ohm, with application circuit)



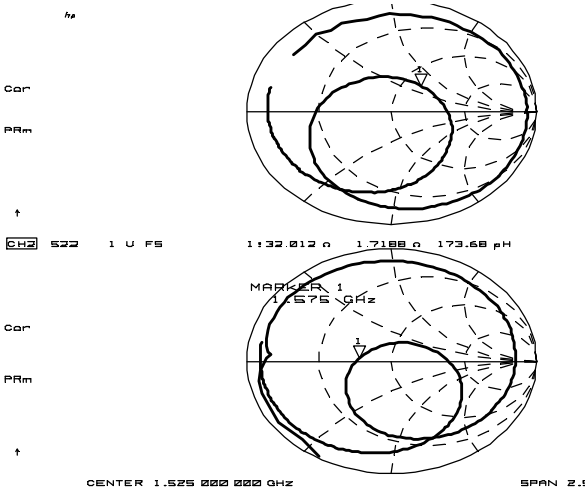
S11, S22



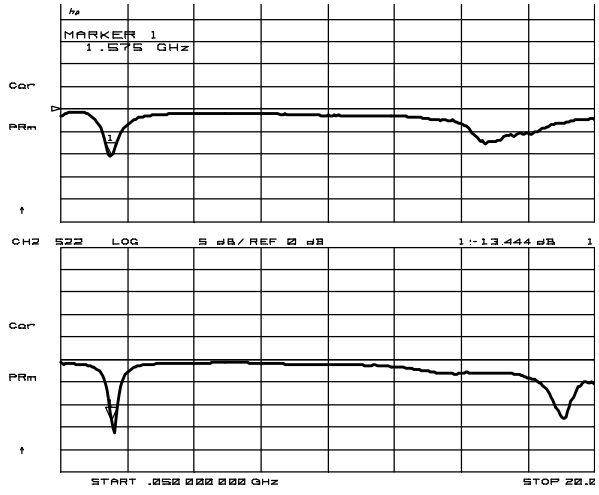
S21, S12



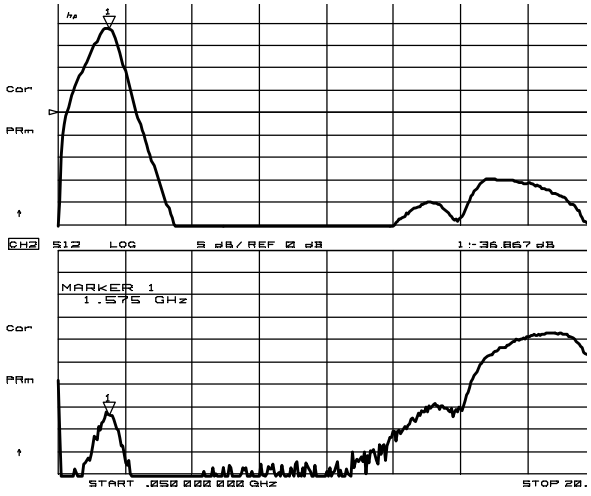
VSWR



Zin, Zout

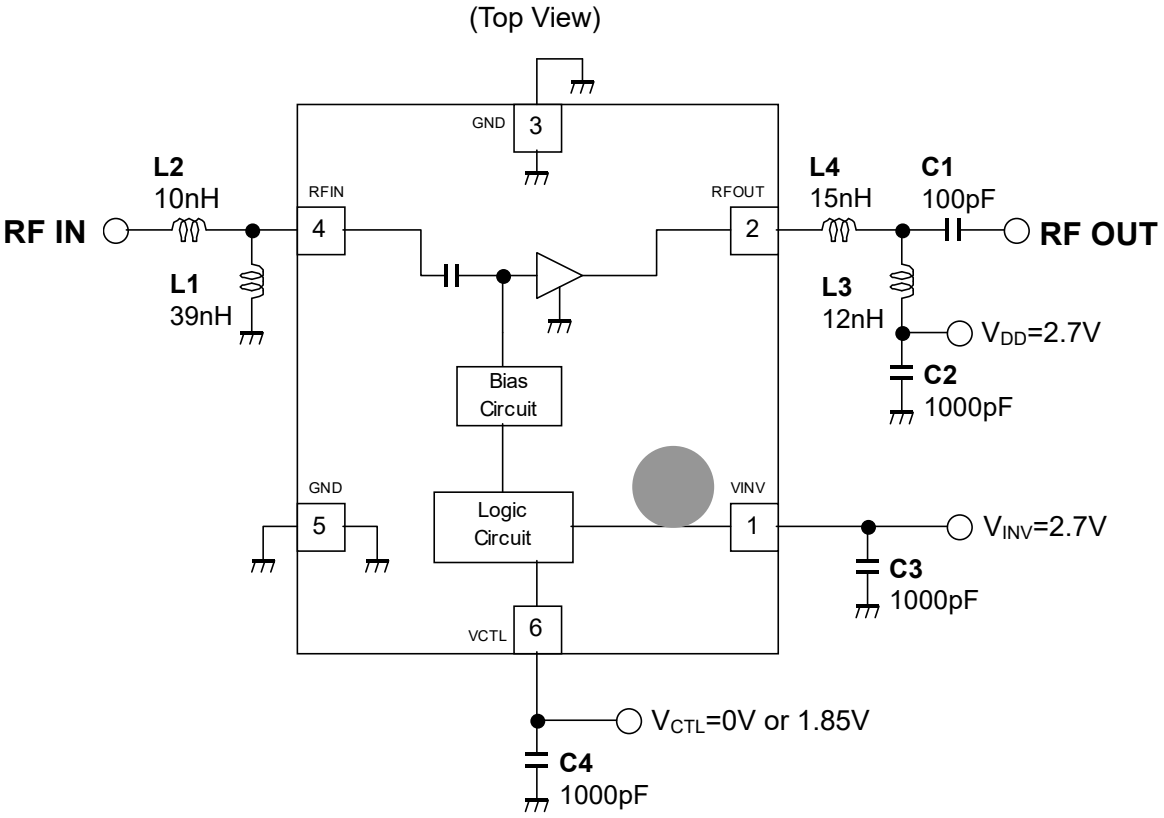


S11, S22 (f=50MHz~20GHz)

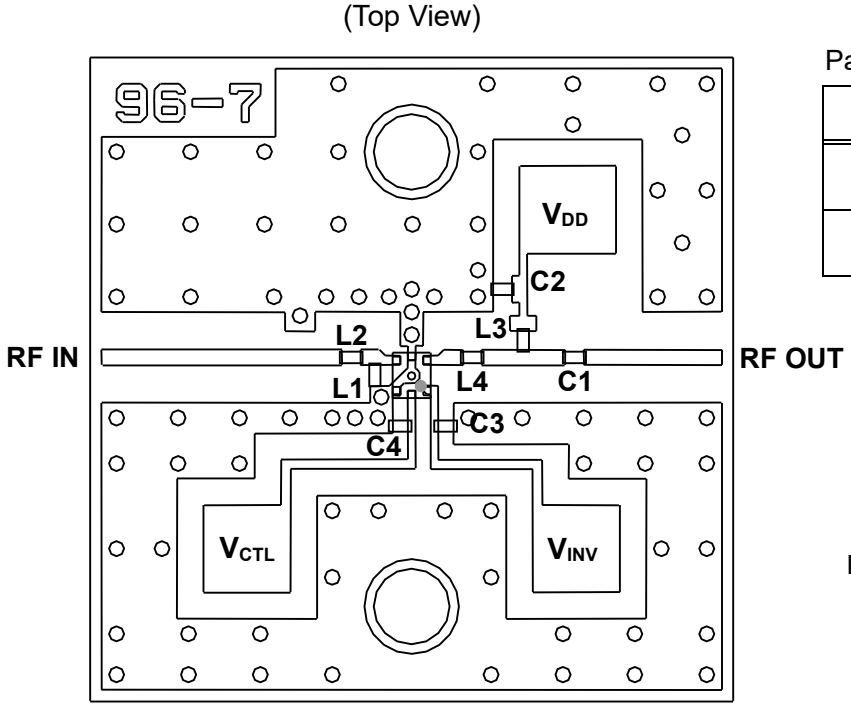


S21, S12 (f=50MHz~20GHz)

■ APPLICATION CIRCUIT



■ TEST PCB LAYOUT

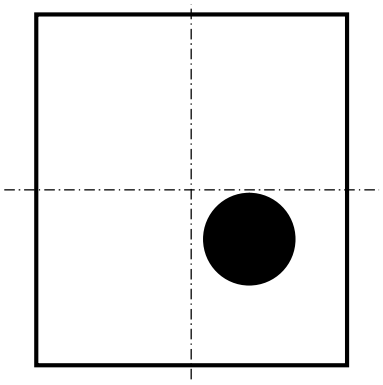


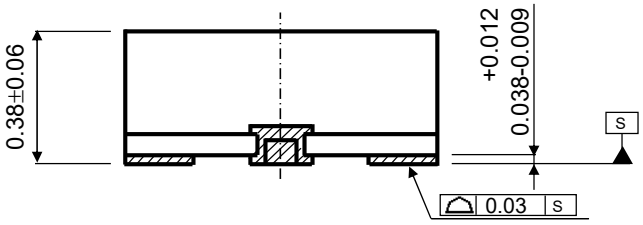
Parts List

Parts ID	Notes
L1~L4	MURATA (LQP03T series)
C1~C4	MURATA (GRM03 series)

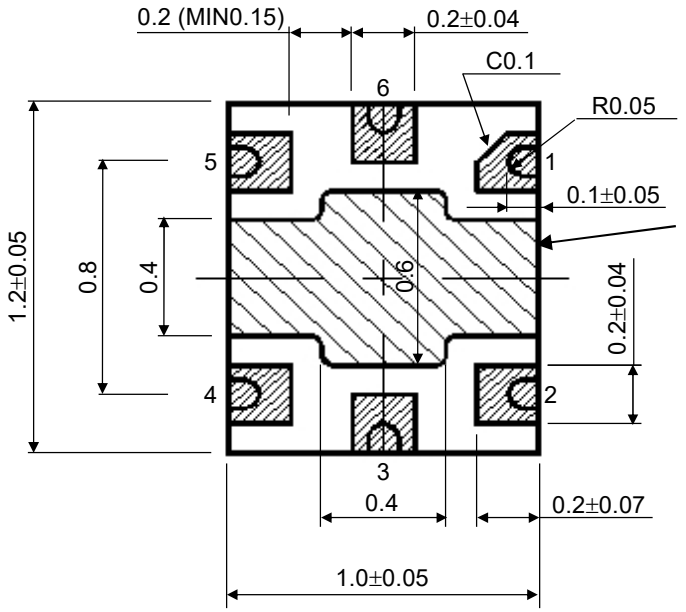
PCB (FR-4): t=0.2mm
MICROSTRIP LINE WIDTH
=0.4mm (Z_0=50ohm)
PCB SIZE=17.0mmx17.0mm

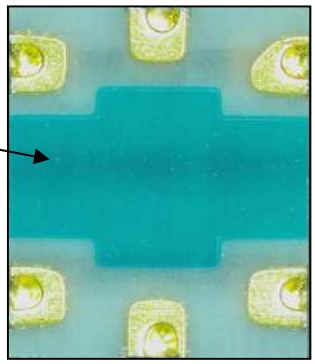
■PACKAGE OUTLINE (USB6-A8)





TERMINAL TREAT	:Au
Substrate	:FR5
Molding material	:Epoxy resin
UNIT	:mm
WEIGHT	:1.1mg





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.

1. The products and the product specifications described in this document are subject to change or discontinuation of production without notice for reasons such as improvement. Therefore, before deciding to use the products, please refer to our sales representatives for the latest information thereon.
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5. The products listed in this document are intended and designed for use as general electronic components in standard applications (office equipment, telecommunication equipment, measuring instruments, consumer electronic products, amusement equipment etc.). Those customers intending to use a product in an application requiring extreme quality and reliability, for example, in a highly specific application where the failure or misoperation of the product could result in human injury or death should first contact us.
    - Aerospace Equipment
    - Equipment Used in the Deep Sea
    - Power Generator Control Equipment (nuclear, steam, hydraulic, etc.)
    - Life Maintenance Medical Equipment
    - Fire Alarms / Intruder Detectors
    - Vehicle Control Equipment (automotive, airplane, railroad, ship, etc.)
    - Various Safety Devices
    - Traffic control system
    - Combustion equipment

    In case your company desires to use this product for any applications other than general electronic equipment mentioned above, make sure to contact our company in advance. Note that the important requirements mentioned in this section are not applicable to cases where operation requirements such as application conditions are confirmed by our company in writing after consultation with your company.
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.

NISSHINBO

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