2-way Active Splitter GaAs MMIC

■ GENERAL DESCRIPTION

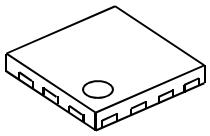
The NJG1151MD7 is 2-way active splitter with normally loop through switch GaAs MMIC for terrestrial applications, and this IC can be tuned to satellite frequency from 1000MHz to 2150MHz.

In order to simplify the tuner structure, the NJG1151MD7 does not only offer a 2-way active splitter, but also supply loop through switch for optimize the complicate circuit.

The NJG1151MD7 achieve better characteristics and high ESD tolerance with less external components.

A small and ultra-thin package of EQFN14-D7 is adopted.

■ PACKAGE OUTLINE



NJG1151MD7

■ APPLICATIONS

STB, TV, Recorder applications, Terrestrial application, Satellite application

■ FEATURES

● Operating frequency	40 to 1000MHz
● Package	EQFN14-D7 (Package size: 1.6x1.6x0.397mm typ.)

[Active mode: Operating voltage 5.0V]

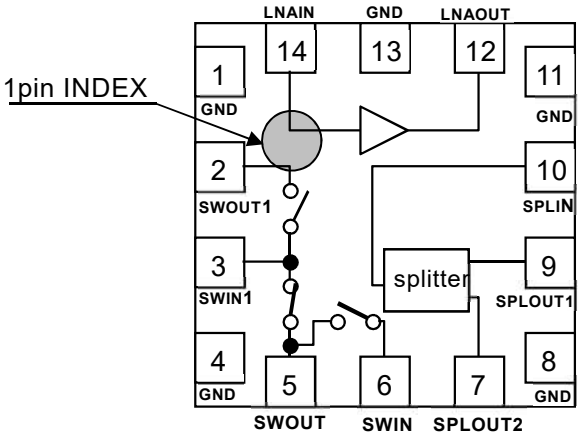
● Operating current	100mA typ.
● Gain	6.0dB typ. (Zs=Zl=50Ω, Zs=Zl=75Ω)
● Noise figure	2.5dB typ. (Zs=Zl=50Ω)
● CSO	60dBc typ. (Zs=Zl=75Ω, 132ch, +15dBmV)
● CTB	65dBc typ. (Zs=Zl=75Ω, 132ch, +15dBmV)
● Output to output isolation	20dB typ. (Zs=Zl=50Ω, Zs=Zl=75Ω)

[Through mode: Operating voltage 0V]

● Insertion loss	0.4dB typ. (Zs=Zl=50Ω)

■ PIN CONFIGURATION

(Top View)



Pin Connection

1. GND	8. GND
2. SWOUT1	9. SPLOUT1
3. SWIN1	10. SPIN1
4. GND	11. GND
5. SWOUT2	12. LNAOUT
6. SWIN2	13. GND
7. SPLOUT2	14. LNAIN

Exposed Pad: 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 / 75 Ω

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNITS
Drain voltage	V_{DD}		6.0	V
Input power	P_{IN}	V_{DD}=5.0V	+10	dBm
Power dissipation	P_D	4-layer FR4 PCB with through-hole (76.2x114.3mm), Tj=150°C	1300	mW
Operating temperature	T_{opr}		-40 to +85	°C
Storage temperature	T_{stg}		-55 to +150	°C

■ ELECTRICAL CHARACTERISTICS (DC CHARACTERISTICS)

V_{DD}=5.0V, T_a=+25°C, with application circuit1

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating voltage	V_{DD}		2.4	5.0	5.5	V
Operating current	I_{DD}	RF OFF	-	100	140	mA

■ **ELECTRICAL CHARACTERISTICS2** (RF CHARACTERISTICS: Active mode, 50Ω)

V_{DD}=5.0V, freq=40 to 1000MHz, T_a=+25°C, Z_S=Z_l=50Ω, with application circuit1

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small signal gain1_1	Gain1_1	Exclude PCB & connector losses (Note1) freq=40 to 900MHz	4.0	6.0	8.0	dB
Small signal gain1_2	Gain1_2	Exclude PCB & connector losses (Note1) freq=40 to 1000MHz	4.0	6.0	9.0	dB
Gain Flatness1_1	Gflat1_1	Exclude PCB & connector losses (Note1) freq=40 to 900MHz	-	1.0	2.0	dB
Gain Flatness1_2	Gflat1_2	Exclude PCB & connector losses (Note1) freq=40 to 1000MHz	-	1.0	3.0	dB
Noise figure1	NF1	Exclude PCB & connector losses (Note2)	-	2.5	3.7	dB
Input power 1dB compression1	$P_{-1dB(IN)1}$		+1.0	+7.0	-	dBm
Input 3rd order intercept point1	IIP3_1	f1=freq, f2=freq+100kHz, P_{IN}=-12dBm	+10.0	+20.0	-	dBm
2nd order intermodulation distortion1	IM2_1	f1=40.75MHz, f2=813.25MHz, fmeas=854MHz, $P_{IN}1$=$P_{IN}2$=-8dBm	37.0	52.0	-	dB
3rd order intermodulation distortion1	IM3_1	f1=893.25MHz, f2=873.25MHz, fmeas=853.25MHz, $P_{IN}1$=$P_{IN}2$=-8dBm	49.0	60.0	-	dB
Reverse Isolation1	ISL1	RF OUT1 to RF IN RF OUT2 to RF IN	20.0	28.0	-	dB
Output to Output Isolation1	OISL1	RF OUT1 to RF OUT2	18.0	20.0	-	dB
RF IN Return loss1	RLi1	RF IN port	8.0	15.0	-	dB
RF OUT Return loss1	RLo1	RF OUT1, RF OUT2 port	13.0	20.0	-	dB

(Note1) Input and output PCB, connector losses (RFIN-RFOUT1): 0.02dB(40MHz), 0.16dB(1000MHz)
Input and output PCB, connector losses (RFIN-RFOUT2): 0.02dB(40MHz), 0.15dB(1000MHz)

(Note2) Input PCB and connector losses: 0.01dB(40MHz), 0.06dB(1000MHz)

■ **ELECTRICAL CHARACTERISTICS3** (RF CHARACTERISTICS: Through mode, 50Ω)

V_{DD}=0V, freq=40 to 1000MHz, T_a=+25°C, Z_S=Z_l=50Ω, with application circuit1

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Insertion Loss2	Loss2	Exclude PCB & connector losses (Note1)	-	0.4	2.0	dB
Input power 1dB Compression2	$P_{-1dB(IN)2}$		+1.0	+10.0	-	dBm
2nd order intermodulation distortion2	IM2_2	f1=90MHz, f2=100MHz, fmeas=190MHz, $P_{IN}1$=$P_{IN}2$=-5dBm	50.0	65.0	-	dB
3rd order intermodulation distortion2	IM3_2	f1=200MHz, f2=210MHz, fmeas=220MHz, $P_{IN}1$=$P_{IN}2$=-5dBm	53.0	70.0	-	dB
RF IN Return loss2	RLi2	RF IN port	8.0	15.0	-	dB
RF OUT Return loss2	RLo2	RF OUT2 port	8.0	15.0	-	dB

(Note1) Input and output PCB, connector losses (RFIN-RFOUT2): 0.02dB(40MHz), 0.15dB(1000MHz)

■ **ELECTRICAL CHARACTERISTICS4** (RF CHARACTERISTICS: Active mode, 75Ω)

V_{DD}=5.0V, freq=40 to 1000MHz, T_a=+25°C, Z_S=Z_l=75Ω, with application circuit1

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small signal gain3 (75Ω)	Gain3	Exclude PCB & connector losses	-	6.0	-	dB
Composite Second Order3	CSO3	132channels, CW, P_{IN}=+15dBmV	-	60.0	-	dBc
Composite Triple Beat 3	CTB3	132channels, CW, P_{IN}=+15dBmV	-	65.0	-	dBc
Reverse Isolation3	ISL3	RF OUT1 to RF IN RF OUT2 to RF IN		28.0		dB
Output to Output Isolation3	OISL3	RF OUT1 to RF OUT2		20.0		dB
RF IN Return loss3 (75Ω)	RLi3	RF IN port	-	15.0	-	dB
RF OUT Return loss3 (75Ω)	RLo3	RF OUT1, RF OUT2 port	-	25.0	-	dB

■ **ELECTRICAL CHARACTERISTICS5** (RF CHARACTERISTICS: Through mode, 75Ω)

V_{DD}=0V, freq=40 to 1000MHz, T_a=+25°C, Z_S=Z_l=75Ω, with application circuit1

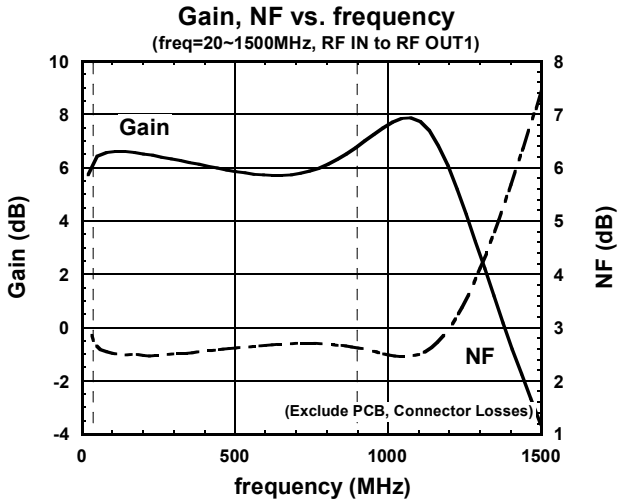
PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Insertion Loss4 (75Ω)	Loss4	Exclude PCB & connector losses	-	1.0	-	dB
Composite Second Order4	CSO4	132channels, CW, P_{IN}=+15dBmV	-	55.0	-	dBc
Composite Triple Beat4	CTB4	132channels, CW, P_{IN}=+15dBmV	-	60.0	-	dBc
RF IN Return loss4 (75Ω)	RLi4	RF IN port	-	15.0	-	dB
RF OUT Return loss4 (75Ω)	RLo4	RF OUT1, RF OUT2 port	-	15.0	-	dB

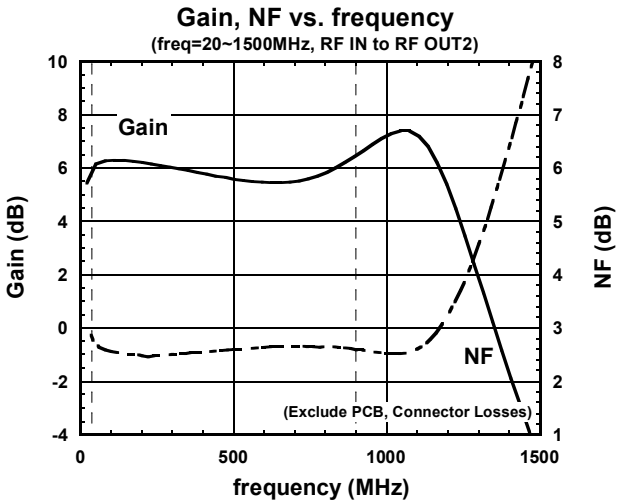
■ TERMINAL DESCRIPTION

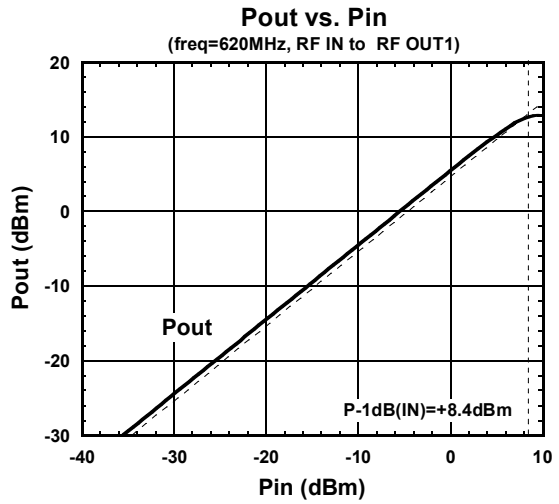
Pin No.	SYMBOL	DESCRIPTION
1	GND	Ground terminal. This terminal should be connected to the ground plane as close as possible for excellent RF performance.
2	SWOUT1	RF signal output terminal of the switch. RF signal is output through the external circuit. Please connect the DC blocking capacitor of the application circuit.
3	SWIN1	RF signal input terminal of the switch. RF signal is input through the external circuit. Please connect the DC blocking capacitor of the application circuit.
4	GND	Ground terminal. This terminal should be connected to the ground plane as close as possible for excellent RF performance.
5	SWOUT2	RF signal output terminal of the switch. RF signal is output through the external circuit. Please connect the DC blocking capacitor of the application circuit.
6	SWIN2	RF signal input terminal of the switch. RF signal is input through the external circuit. Please connect the DC blocking capacitor of the application circuit.
7	SPLOUT2	RF signal output terminal of the splitter.
8	GND	Ground terminal. This terminal should be connected to the ground plane as close as possible for excellent RF performance.
9	SPLOUT1	RF signal output terminal of the splitter.
10	SPLIN	RF signal input terminal of the splitter.
11	GND	Ground terminal. This terminal should be connected to the ground plane as close as possible for excellent RF performance.
12	LNAOUT	RF signal output terminal of the LNA. RF signal is output through the external circuit. This terminal is also a voltage supply terminal of the switch and LNA, Please supply the voltage through an inductor of the application circuit.
13	GND	Ground terminal. This terminal should be connected to the ground plane as close as possible for excellent RF performance.
14	LNAIN	RF signal input terminal of the LNA. RF signal is input through the external circuit. This terminal is also a current adjustment terminal of the LNA, Please connect to ground via a resistor of the application circuit.
Exposed Pad	GND	Ground terminal.

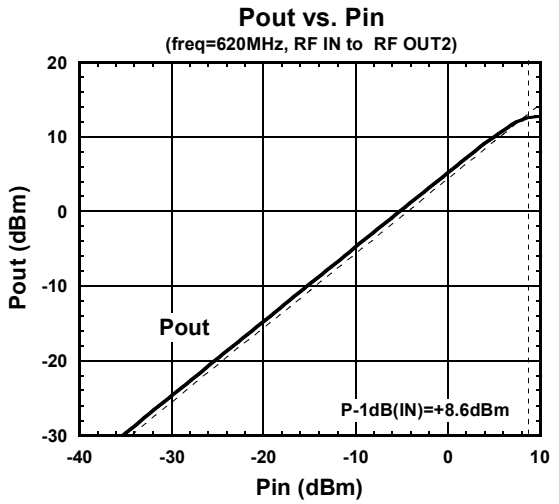
■ ELECTRICAL CHARACTERISTICS (Active mode, 50Ω)

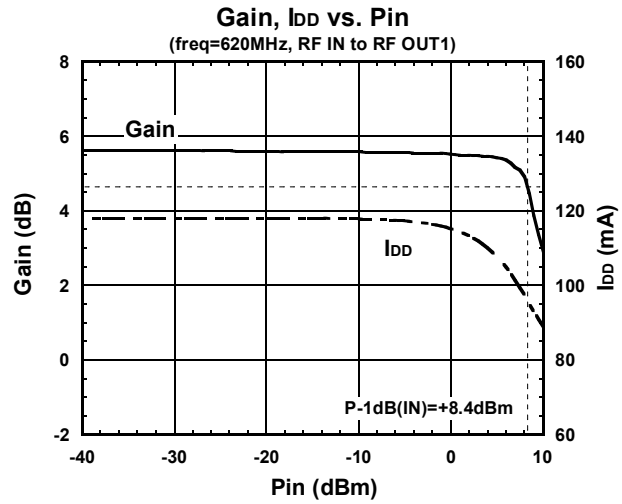
Conditions: V_{DD}=5.0V, Ta=25°C, Z_s=Z_l=50Ω, with application circuit1

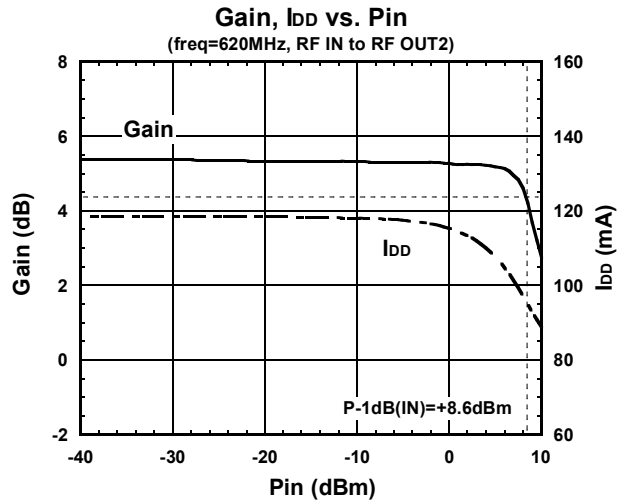








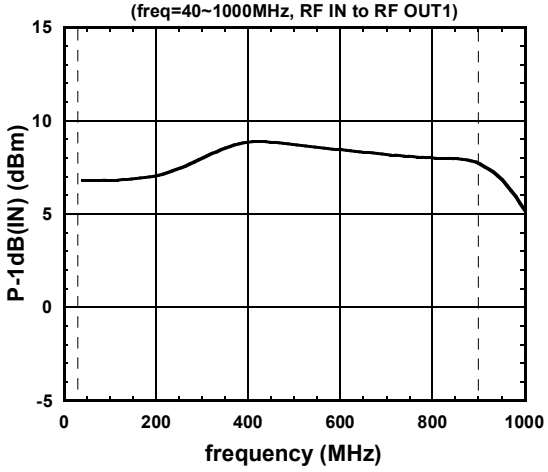




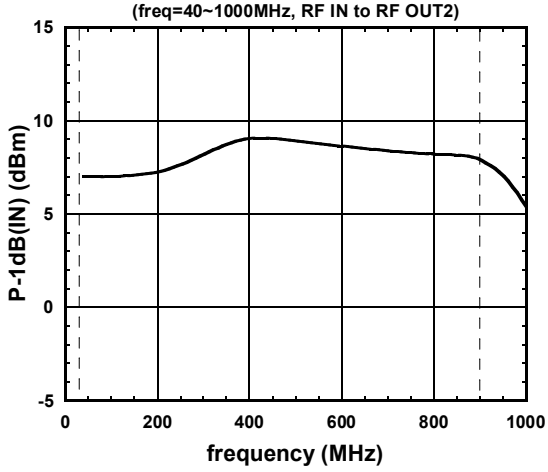
■ **ELECTRICAL CHARACTERISTICS** (Active mode, 50Ω)

Conditions: V_{DD}=5.0V, Ta=25°C, Z_s=Z_l=50Ω, with application circuit1

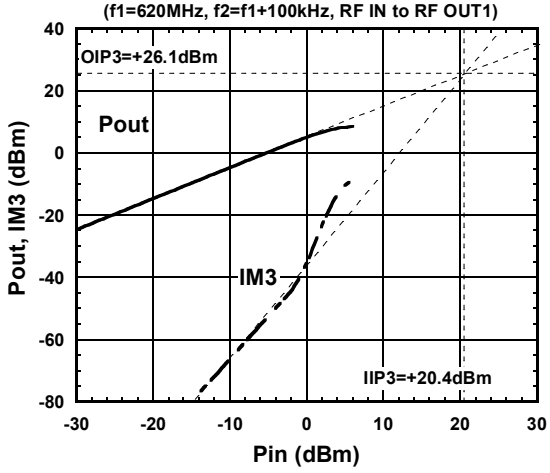
P-1dB(IN) vs. frequency
(freq=40~1000MHz, RF IN to RF OUT1)



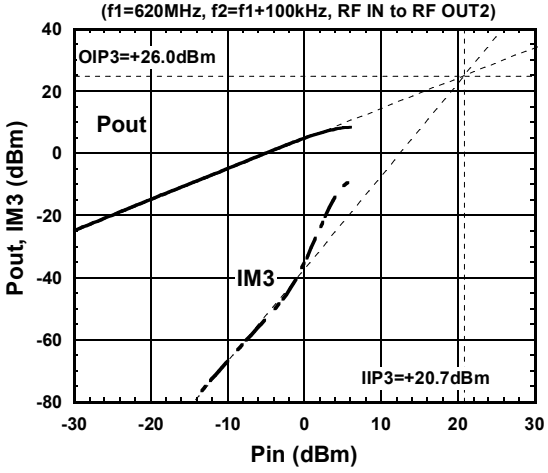
P-1dB(IN) vs. frequency
(freq=40~1000MHz, RF IN to RF OUT2)



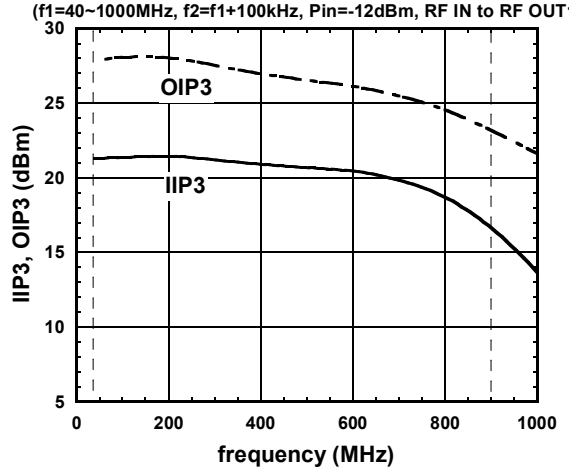
Pout, IM3 vs. Pin
(f1=620MHz, f2=f1+100kHz, RF IN to RF OUT1)



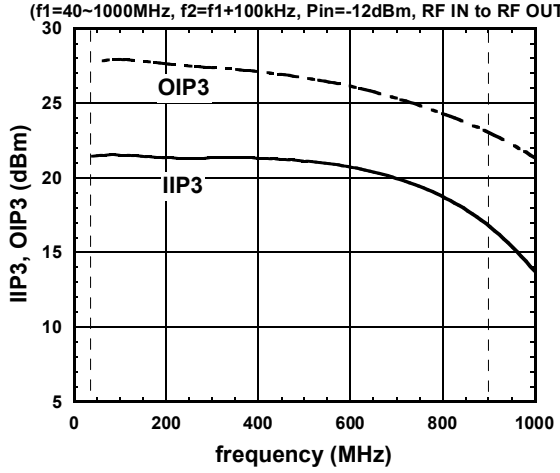
Pout, IM3 vs. Pin
(f1=620MHz, f2=f1+100kHz, RF IN to RF OUT2)



IIP3, OIP3 vs. frequency
(f1=40~1000MHz, f2=f1+100kHz, Pin=-12dBm, RF IN to RF OUT1)



IIP3, OIP3 vs. frequency
(f1=40~1000MHz, f2=f1+100kHz, Pin=-12dBm, RF IN to RF OUT2)

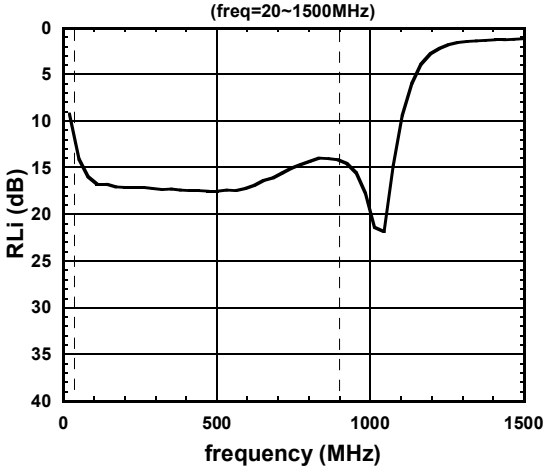


■ **ELECTRICAL CHARACTERISTICS** (Active mode, 50Ω)

Conditions: V_{DD}=5.0V, Ta=25°C, Z_s=Z_l=50Ω, with application circuit1

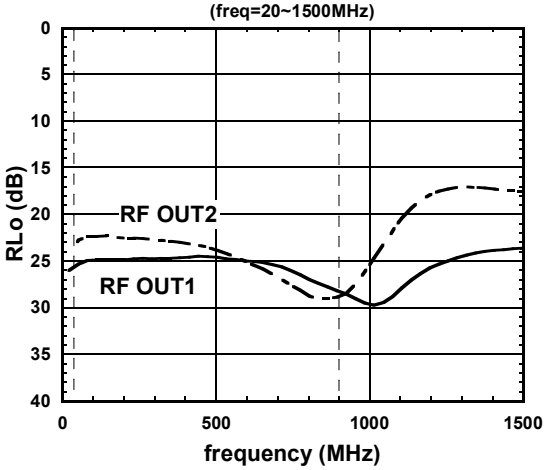
RF IN Return Loss vs. frequency

(freq=20~1500MHz)



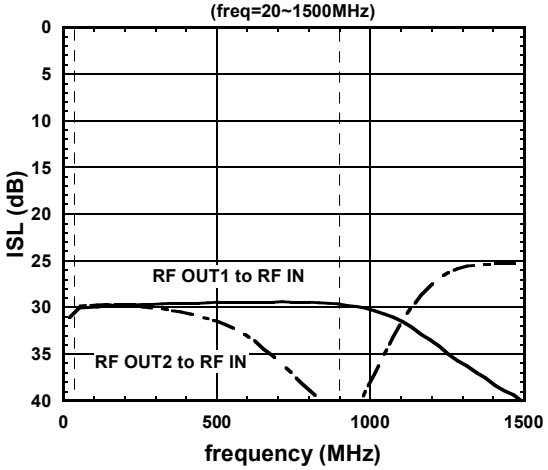
RF OUT Return Loss vs. frequency

(freq=20~1500MHz)



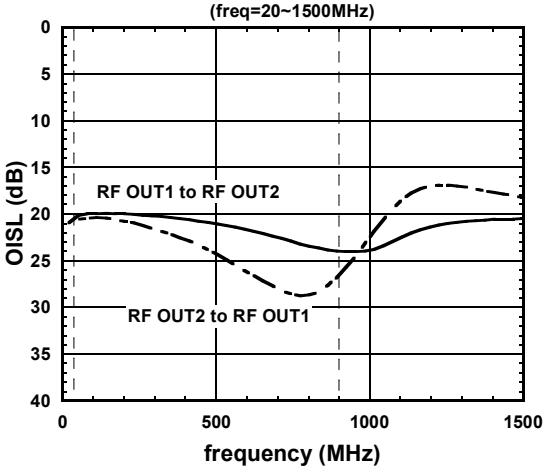
Reverse Isolation vs. frequency

(freq=20~1500MHz)



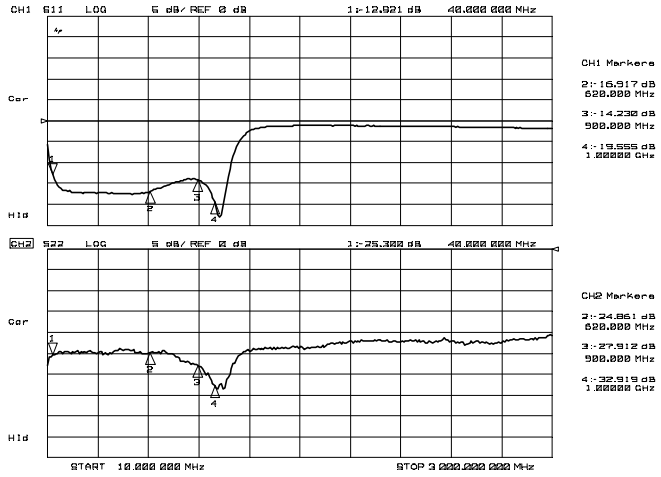
Output to Output Isolation vs. frequency

(freq=20~1500MHz)

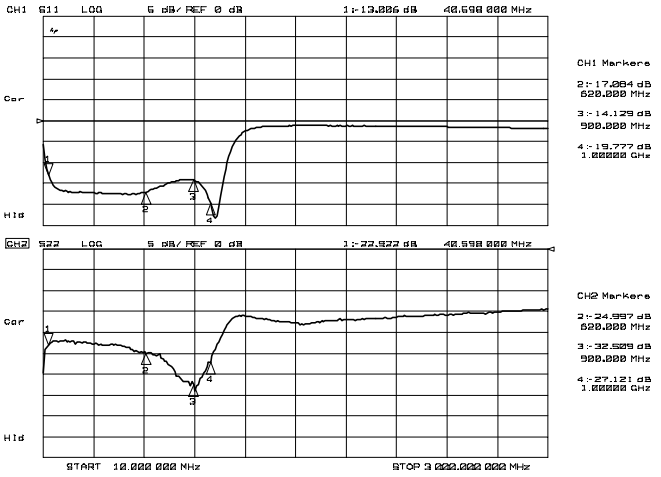


■ ELECTRICAL CHARACTERISTICS (Active mode, 50Ω)

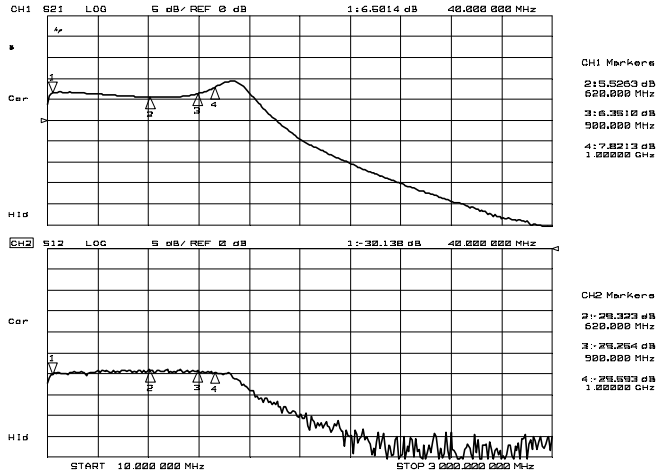
Conditions: V_{DD}=5.0V, Ta=25°C, Z_s=Z_l=50Ω, with application circuit1



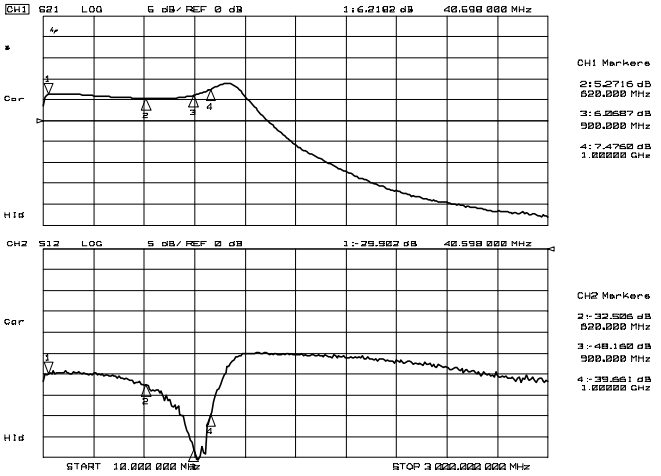
S11, S22 (RF OUT1)



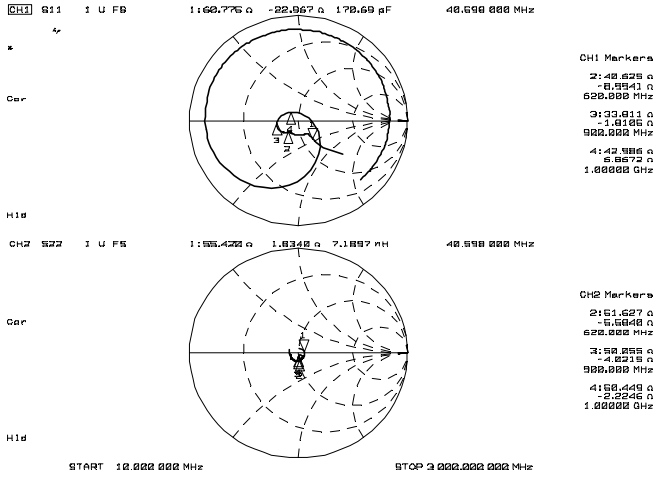
S11, S22 (RF OUT2)



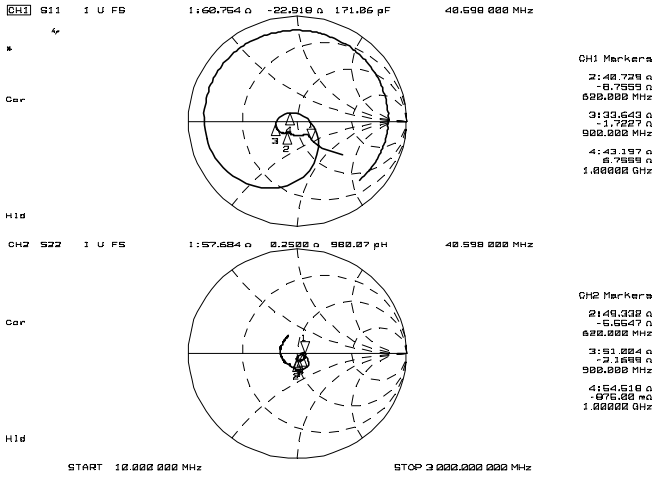
S21, S12 (RF OUT1)



S21, S12 (RF OUT2)



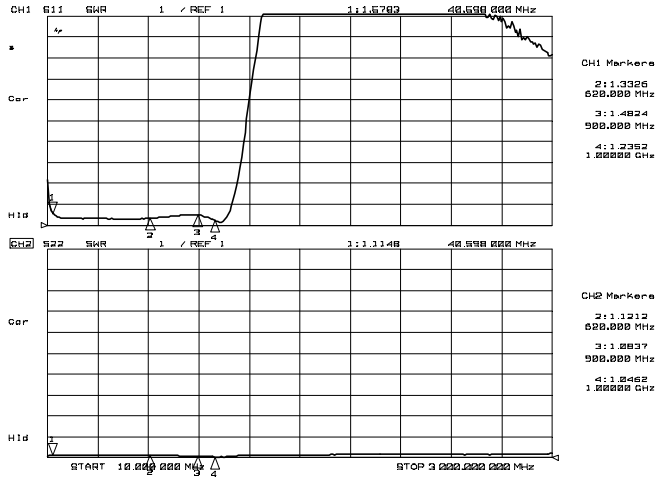
Zin, Zout (RF OUT1)



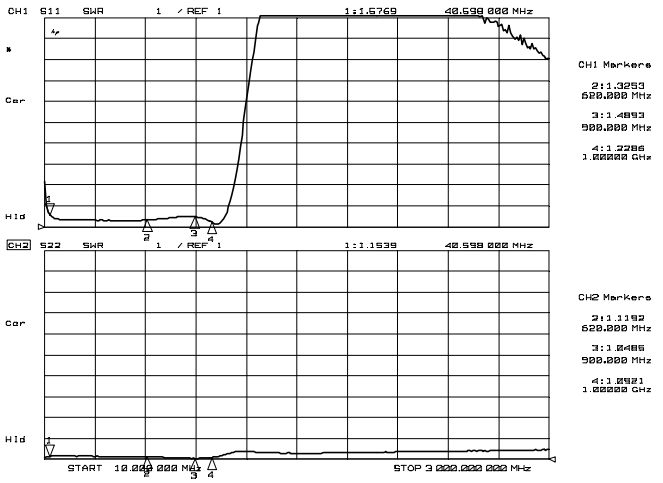
Zin, Zout (RF OUT2)

■ ELECTRICAL CHARACTERISTICS (Active mode, 50Ω)

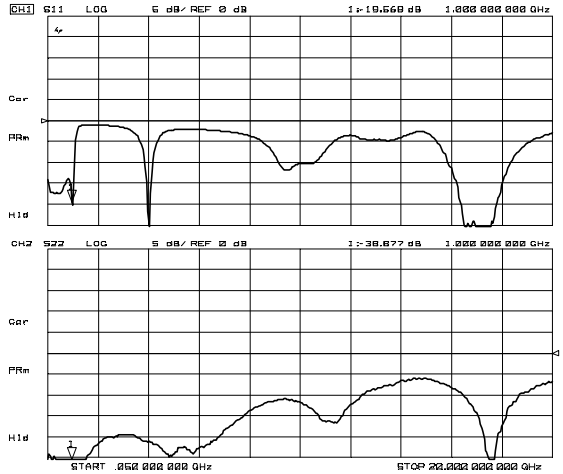
Conditions: V_{DD}=5.0V, Ta=25°C, Z_s=Z_l=50Ω, with application circuit1



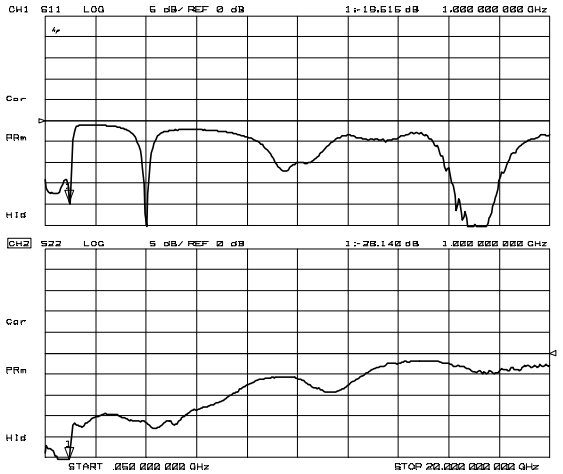
VSWRi, VSWRo (RF OUT1)



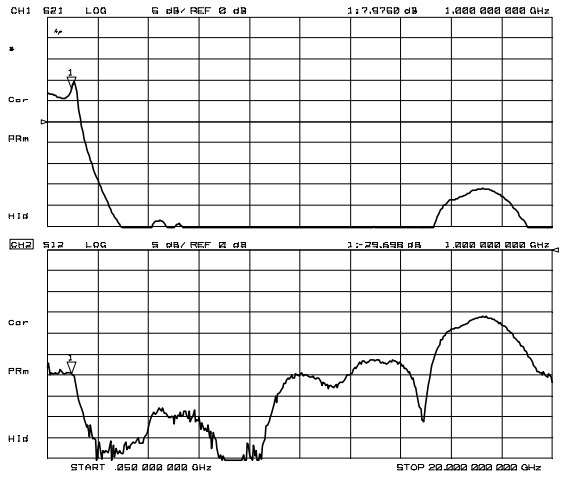
VSWRi, VSWRo (RF OUT2)



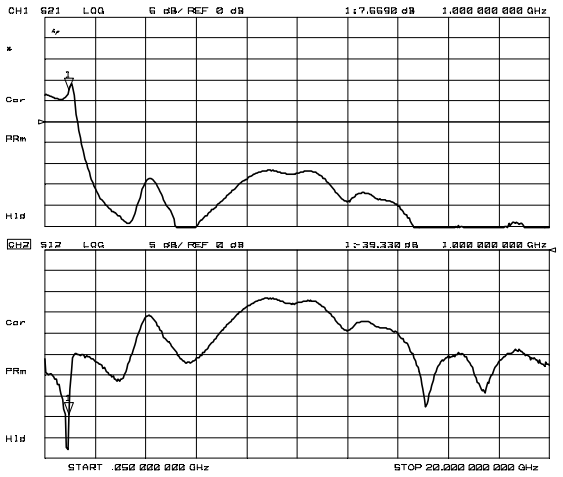
S11, S22 (50MHz to 20GHz, RF OUT1)



S11, S22 (50MHz to 20GHz, RF OUT2)



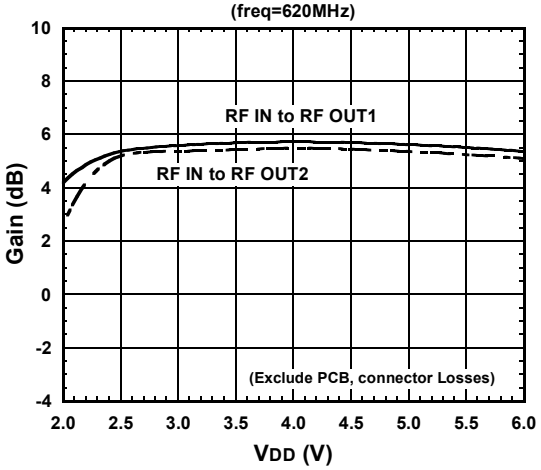
S21, S12 (50MHz to 20GHz, RF OUT1)



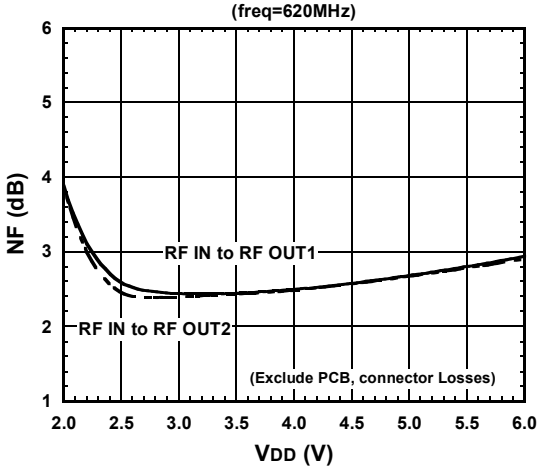
S21, S12 (50MHz to 20GHz, RF OUT2)

■ **ELECTRICAL CHARACTERISTICS** (Active mode, 50Ω)
Conditions: Ta=25°C, Z_s=Z_l=50Ω, with application circuit1

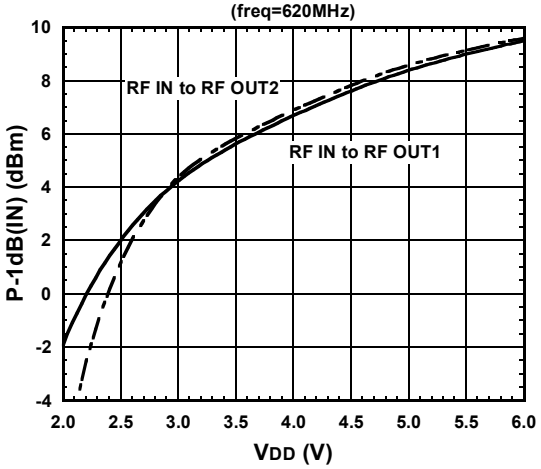
Gain vs. V_{DD}
(freq=620MHz)



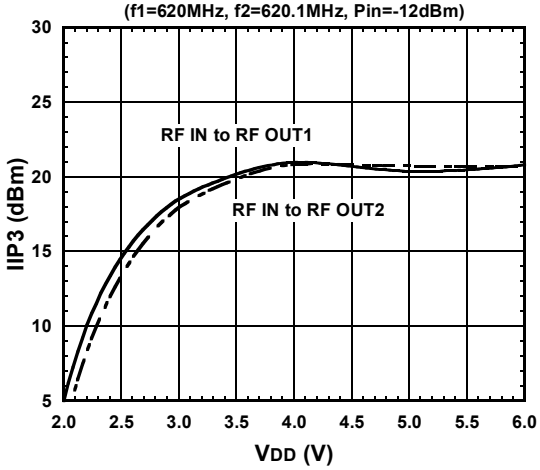
NF vs. V_{DD}
(freq=620MHz)



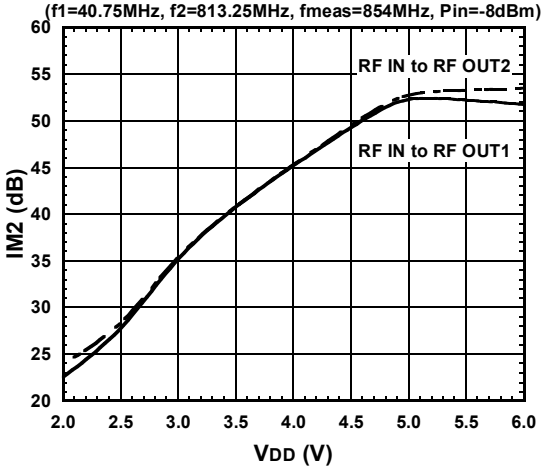
P-1dB(IN) vs. V_{DD}
(freq=620MHz)



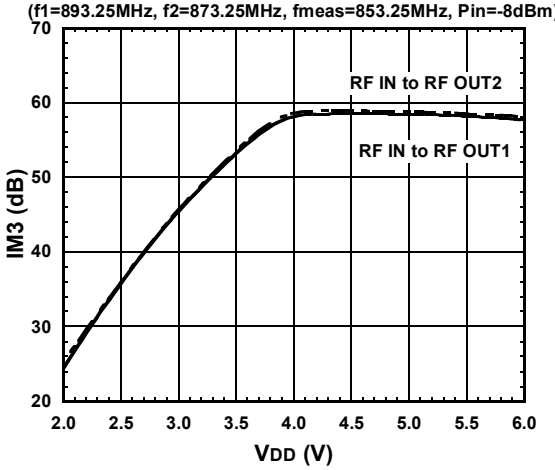
IIP3 vs. V_{DD}
(f1=620MHz, f2=620.1MHz, Pin=-12dBm)



IM2 vs. V_{DD}
(f1=40.75MHz, f2=813.25MHz, fmeas=854MHz, Pin=-8dBm)

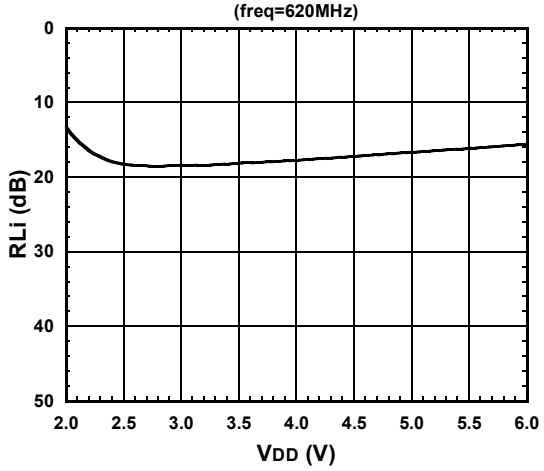


IM3 vs. V_{DD}
(f1=893.25MHz, f2=873.25MHz, fmeas=853.25MHz, Pin=-8dBm)

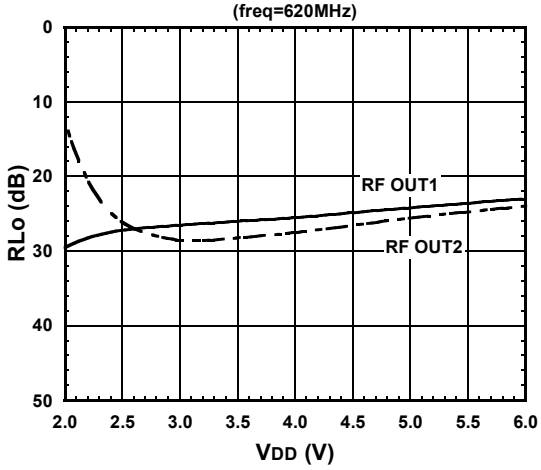


■ **ELECTRICAL CHARACTERISTICS** (Active mode, 50Ω)
Conditions: Ta=25°C, Z_s=Z_l=50Ω, with application circuit1

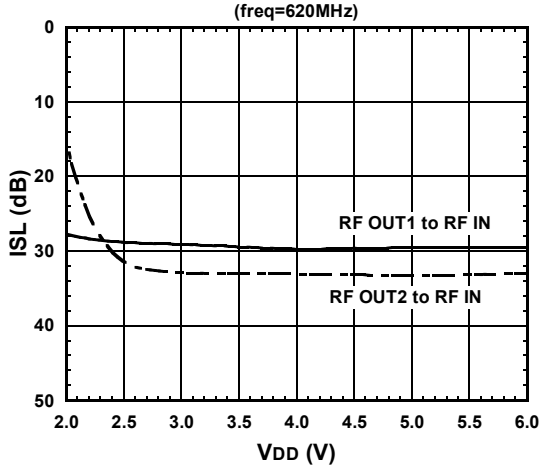
RF IN Return Loss vs. V_{DD}
(freq=620MHz)



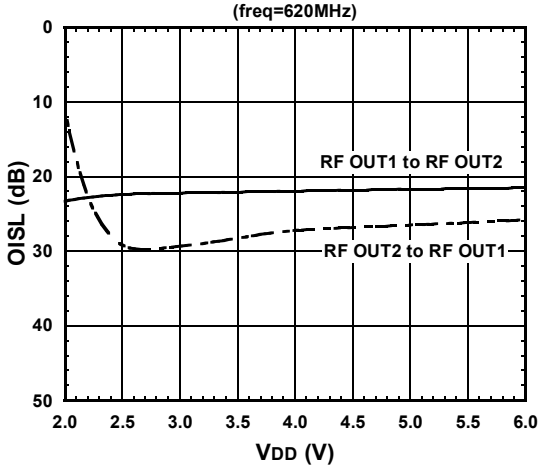
RF OUT Return Loss vs. V_{DD}
(freq=620MHz)



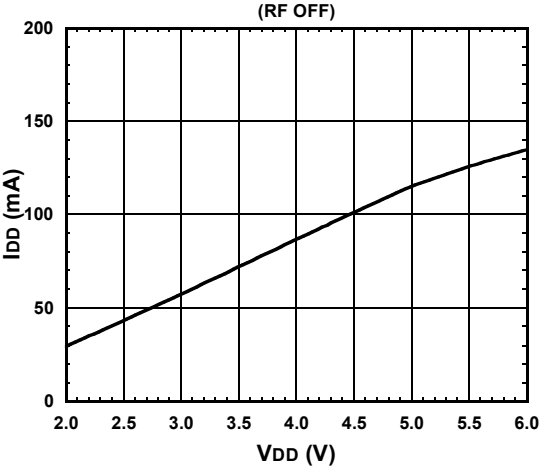
Reverse Isolation vs. V_{DD}
(freq=620MHz)



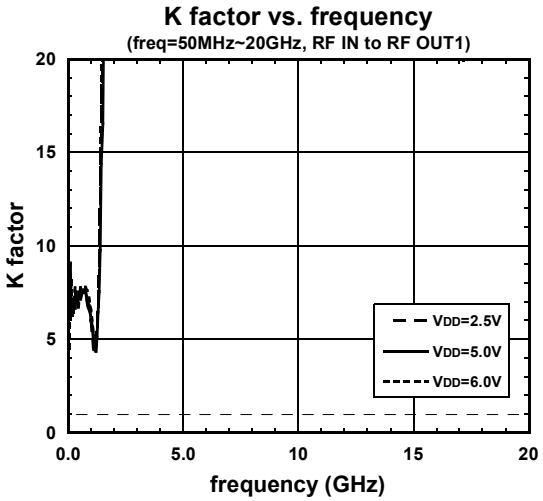
Output to Output Isolation vs. V_{DD}
(freq=620MHz)

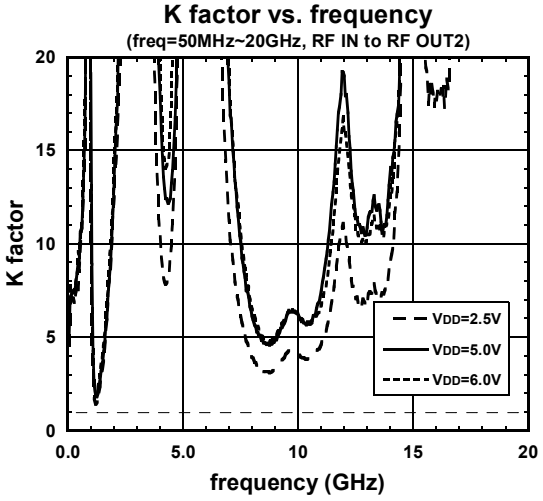


I_{DD} vs. V_{DD}
(RF OFF)



■ **ELECTRICAL CHARACTERISTICS** (Active mode, 50Ω)
Conditions: Ta=25°C, Z_s=Z_l=50Ω, with application circuit1

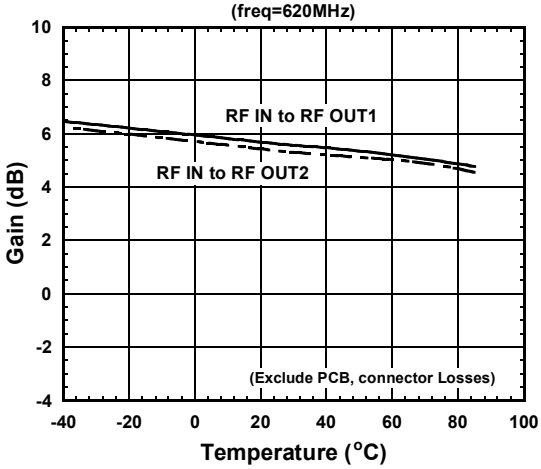




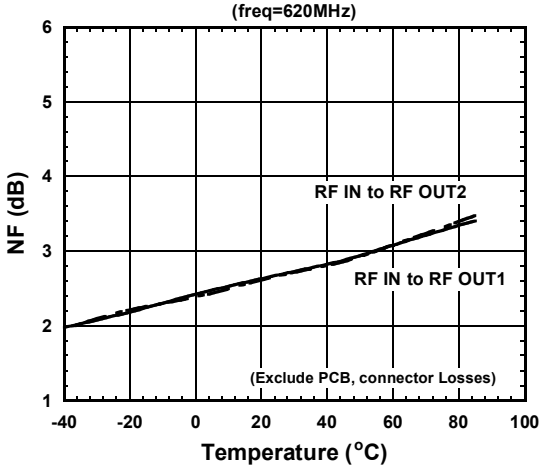
■ ELECTRICAL CHARACTERISTICS (Active mode, 50Ω)

Conditions: V_{DD}=5.0V, Z_s=Z_l=50Ω, with application circuit1

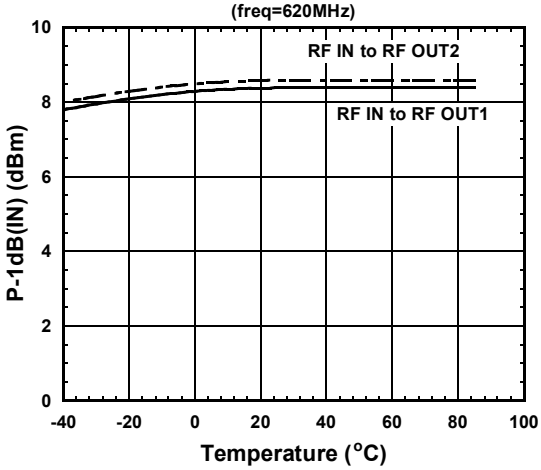
Gain vs. Temperature
(freq=620MHz)



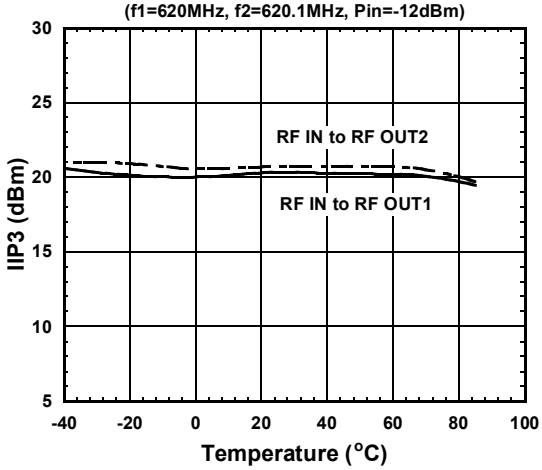
NF vs. Temperature
(freq=620MHz)



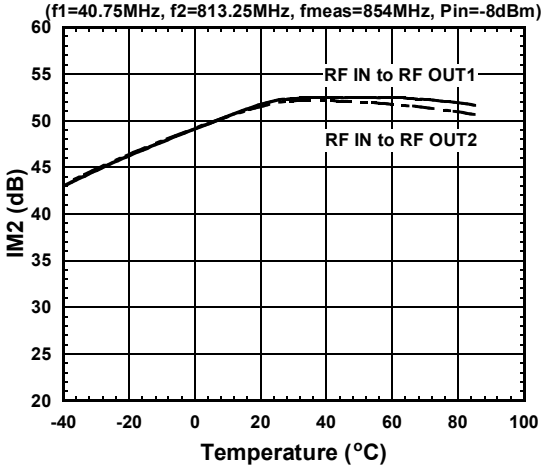
P-1dB(IN) vs. Temperature
(freq=620MHz)



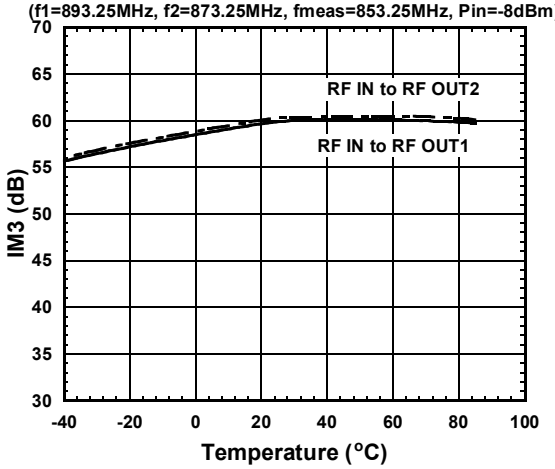
IIP3 vs. Temperature
(f1=620MHz, f2=620.1MHz, Pin=-12dBm)



IM2 vs. Temperature
(f1=40.75MHz, f2=813.25MHz, fmeas=854MHz, Pin=-8dBm)



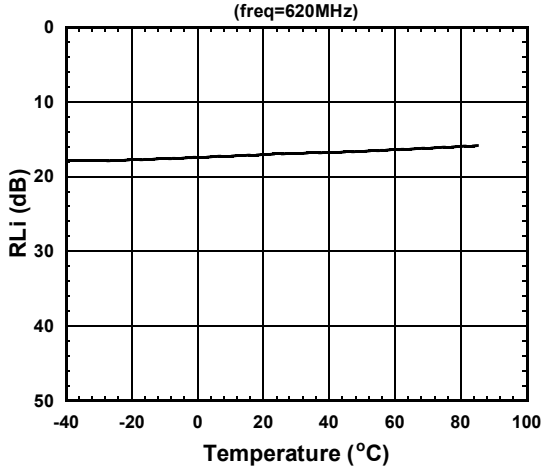
IM3 vs. Temperature
(f1=893.25MHz, f2=873.25MHz, fmeas=853.25MHz, Pin=-8dBm)



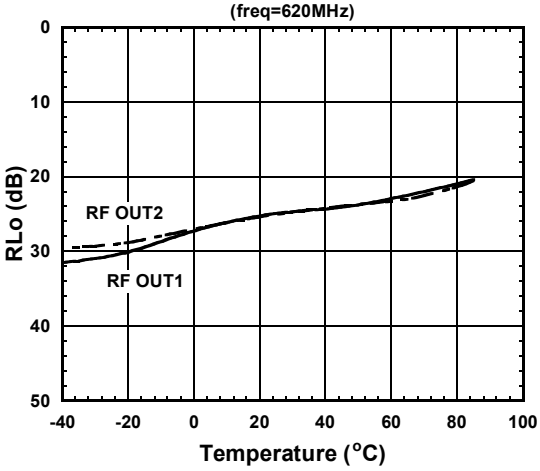
■ ELECTRICAL CHARACTERISTICS (Active mode, 50Ω)

Conditions: V_{DD}=5.0V, Z_s=Z_l=50Ω, with application circuit1

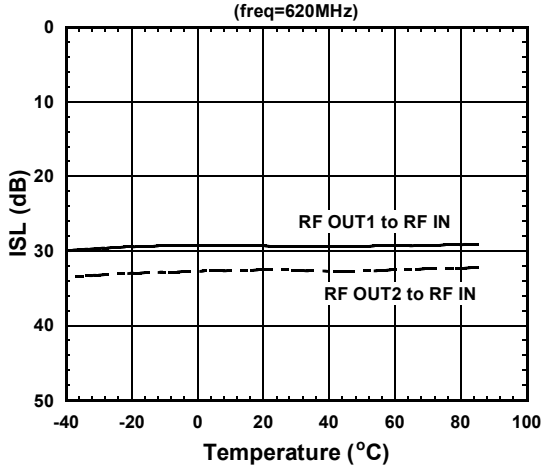
RF IN Return Loss vs. Temperature
(freq=620MHz)



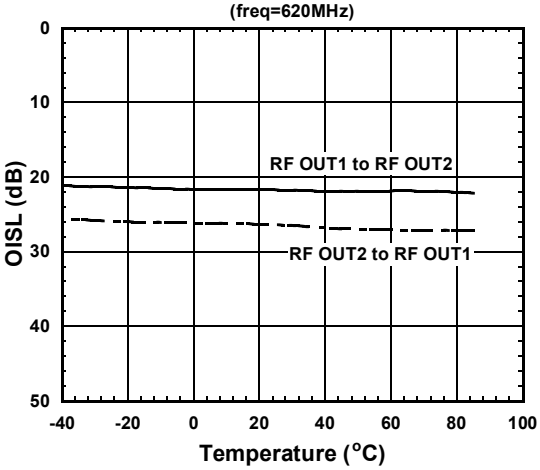
RF OUT Return Loss vs. Temperature
(freq=620MHz)



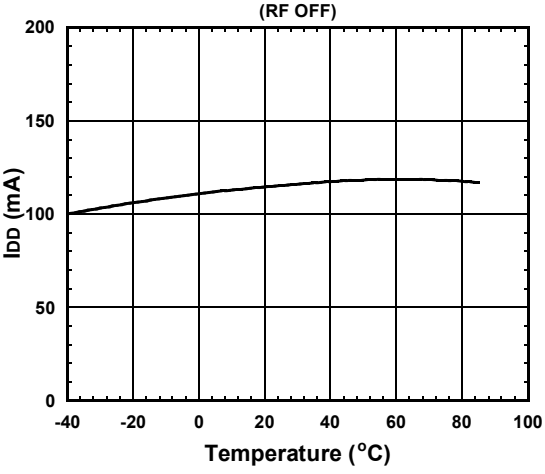
Reverse Isolation vs. Temperature
(freq=620MHz)



Output to Output Isolation vs. Temperature
(freq=620MHz)

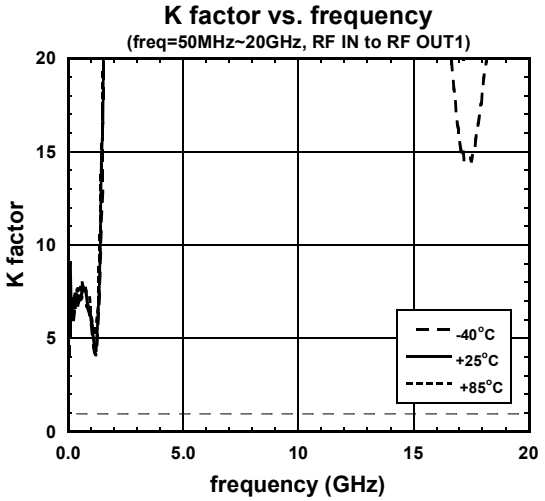


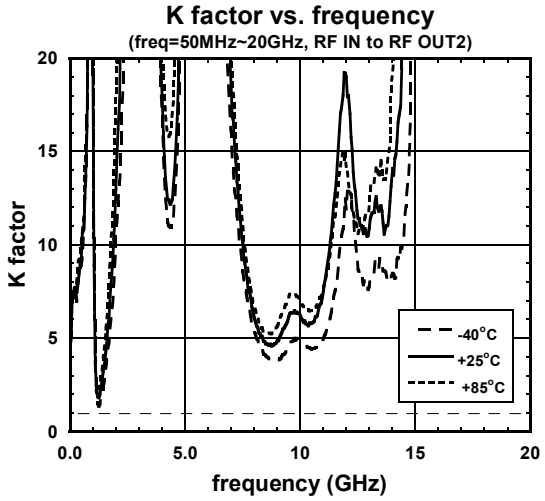
I_{DD} vs. Temperature
(RF OFF)



■ **ELECTRICAL CHARACTERISTICS** (Active mode, 50Ω)

Conditions: V_{DD}=5.0V, Z_s=Z_l=50Ω, with application circuit1

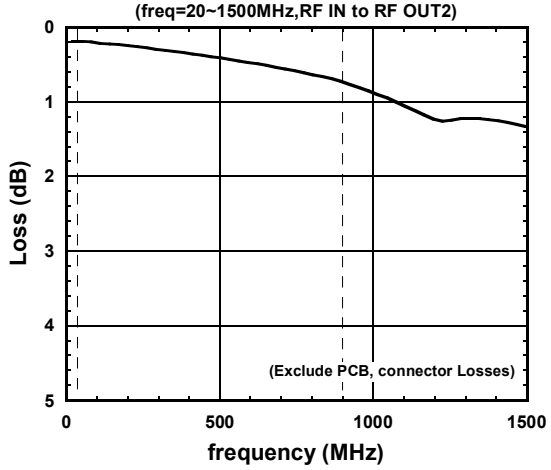




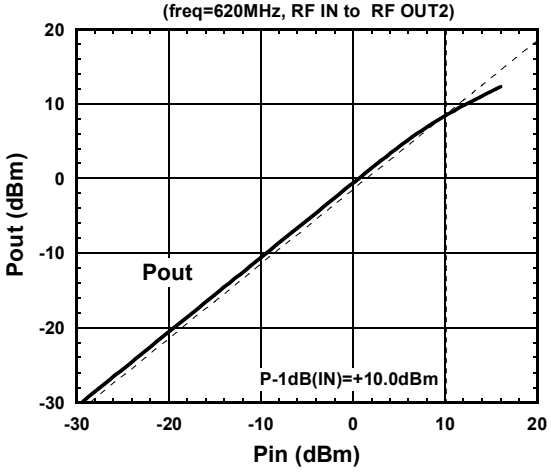
■ **ELECTRICAL CHARACTERISTICS** (Through mode, 50Ω)

Conditions: V_{DD}=0V, Ta=25°C, Z_s=Z_l=50Ω, with application circuit1

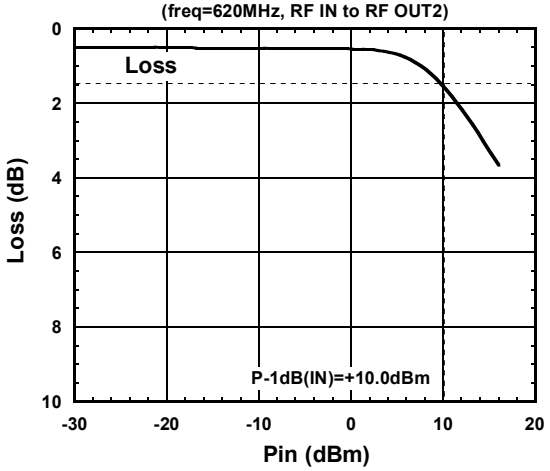
Insertion Loss vs. frequency
(freq=20~1500MHz,RF IN to RF OUT2)



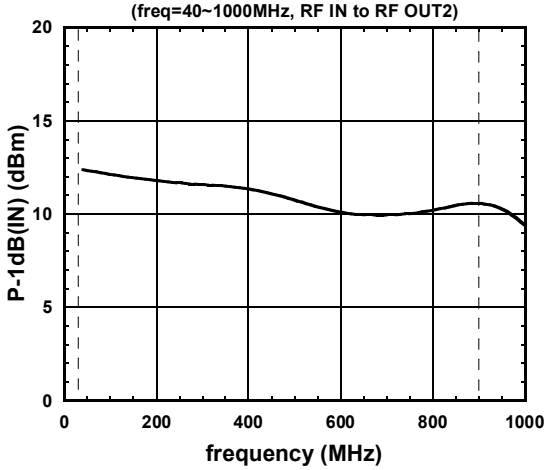
Pout vs. Pin
(freq=620MHz, RF IN to RF OUT2)



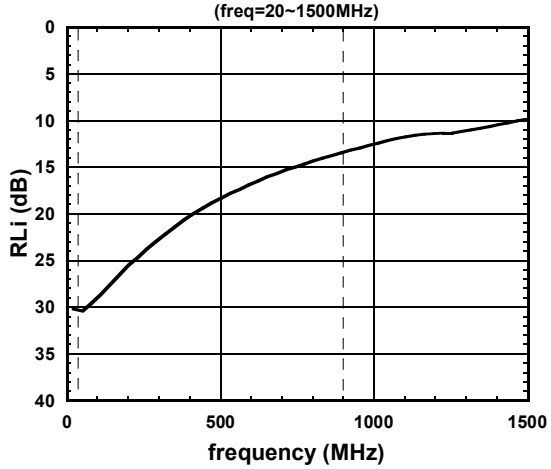
Loss vs. Pin
(freq=620MHz, RF IN to RF OUT2)



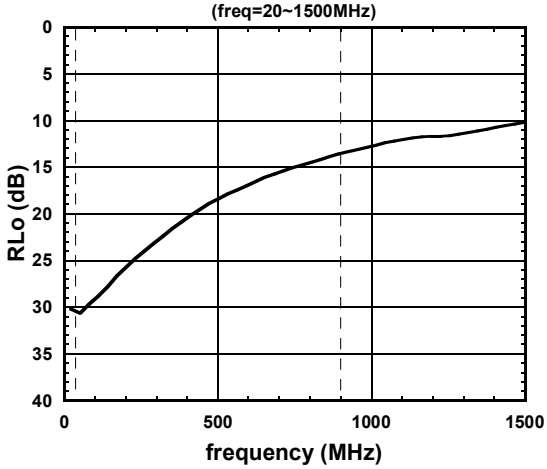
P-1dB(IN) vs. frequency
(freq=40~1000MHz, RF IN to RF OUT2)



RF IN Return Loss vs. frequency
(freq=20~1500MHz)

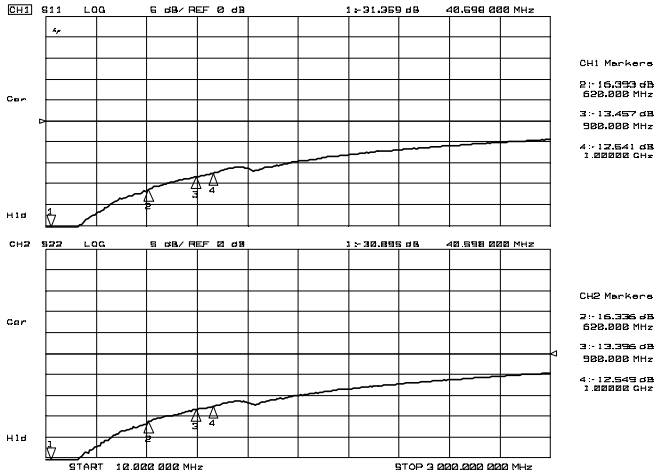


RF OUT2 Return Loss vs. frequency
(freq=20~1500MHz)

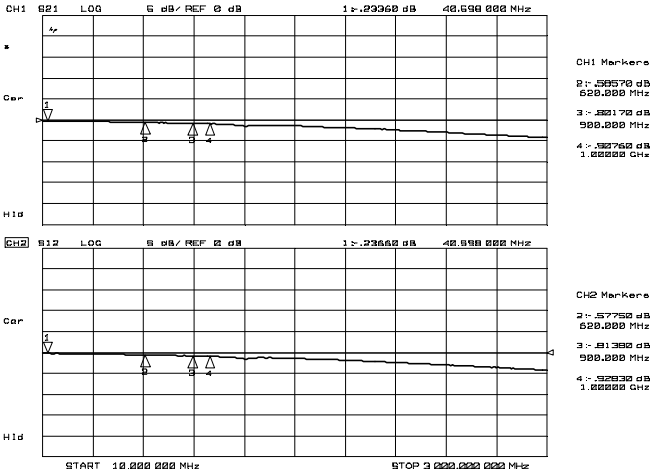


■ ELECTRICAL CHARACTERISTICS (Through mode, 50Ω)

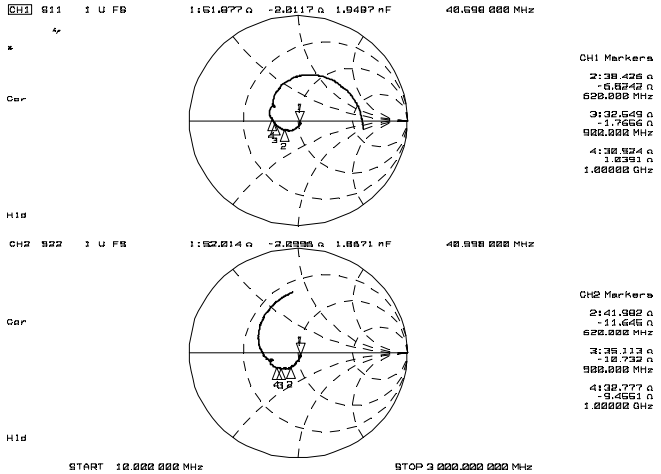
Conditions: V_{DD}=0V, Ta=25°C, Z_s=Z_l=50Ω, with application circuit1



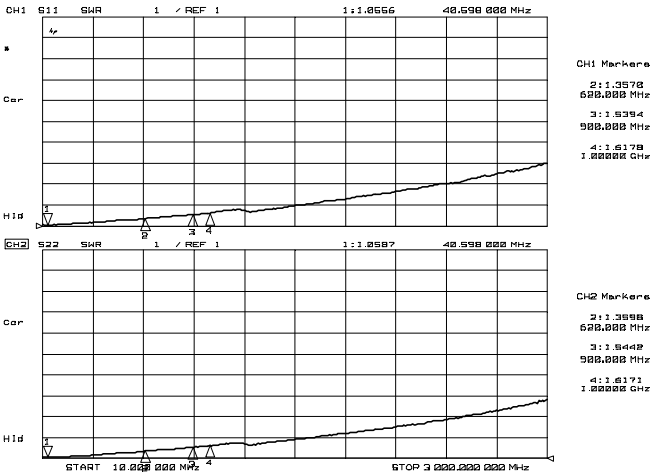
S11, S22



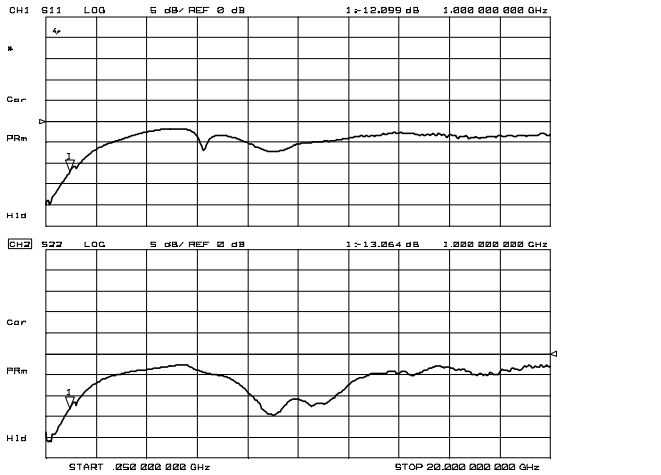
S21, S12



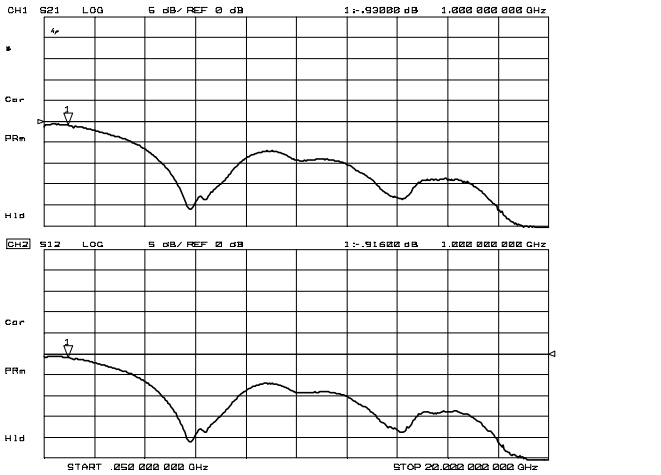
Zin, Zout



VSWRi, VSWRo



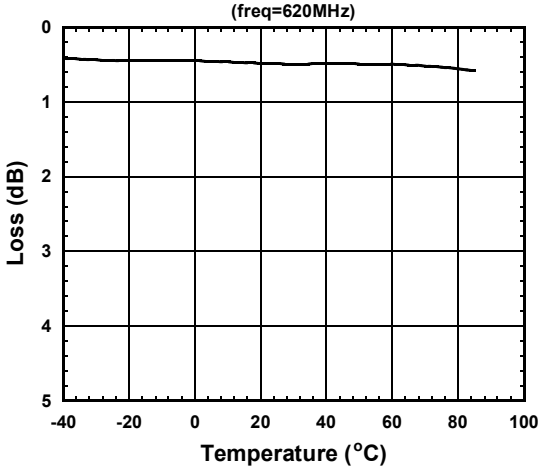
S11, S22 (50MHz to 20GHz)



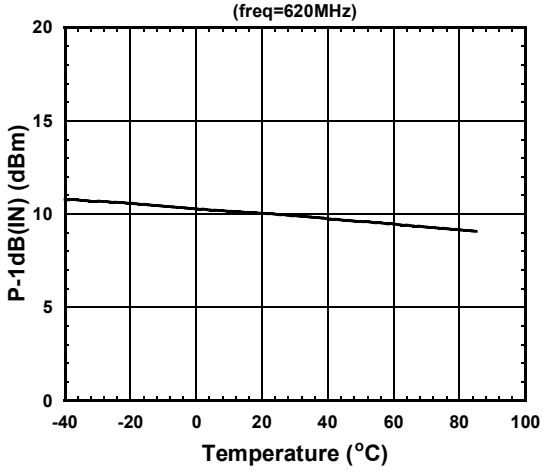
S21, S21 (50MHz to 20GHz)

■ **ELECTRICAL CHARACTERISTICS** (Through mode, 50Ω)
Conditions: V_{DD}=0V, Z_s=Z_l=50Ω, with application circuit1

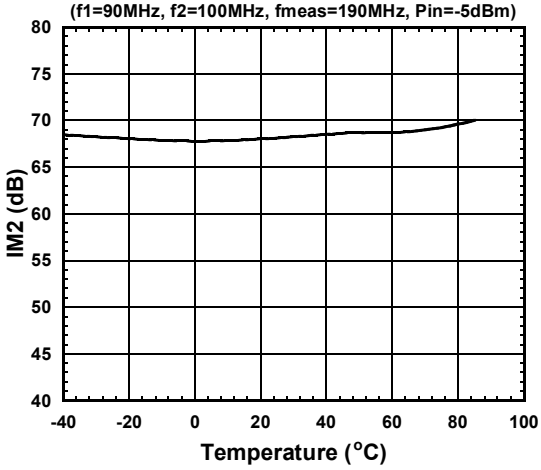
Insertion Loss vs. Temperature
(freq=620MHz)



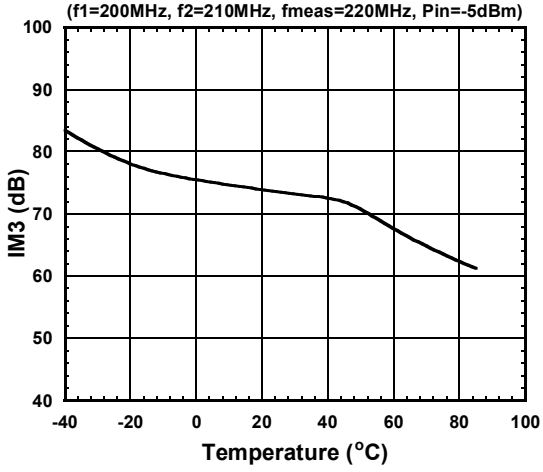
P-1dB(IN) vs. Temperature
(freq=620MHz)



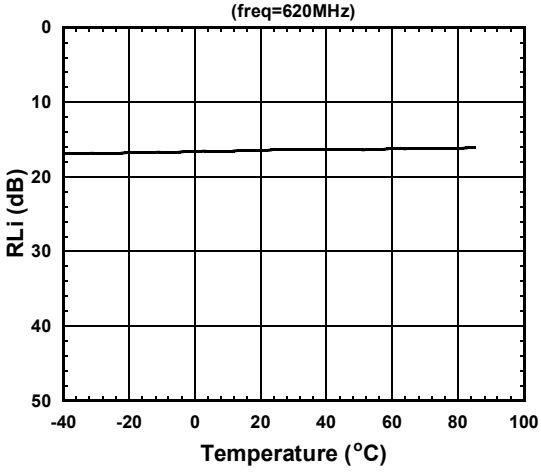
IM2 vs. Temperature
(f1=90MHz, f2=100MHz, fmeas=190MHz, Pin=-5dBm)



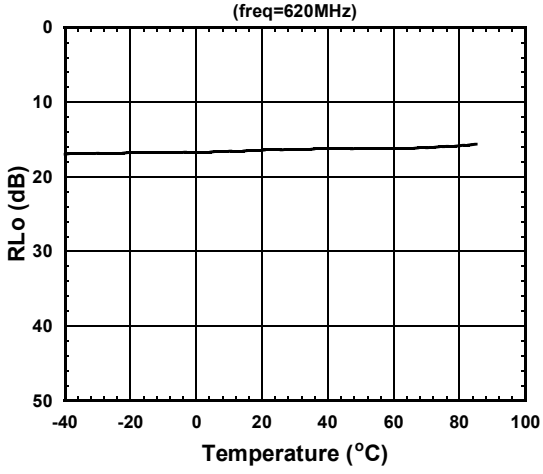
IM3 vs. Temperature
(f1=200MHz, f2=210MHz, fmeas=220MHz, Pin=-5dBm)



RF IN Return Loss vs. Temperature
(freq=620MHz)



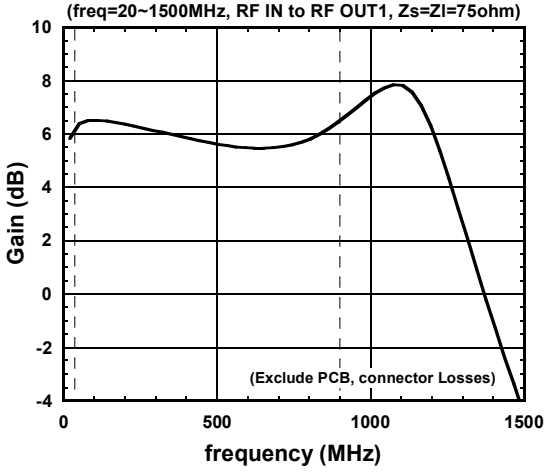
RF OUT Return Loss vs. Temperature
(freq=620MHz)



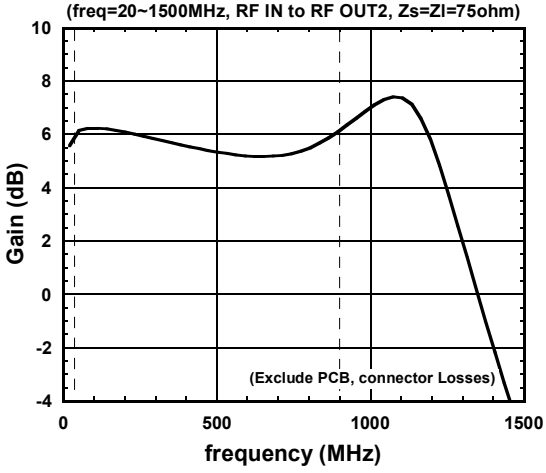
■ ELECTRICAL CHARACTERISTICS (Active mode, 75Ω)

Conditions: V_{DD}=5.0V, Ta=25°C, Z_s=Z_l=75Ω, with application circuit1

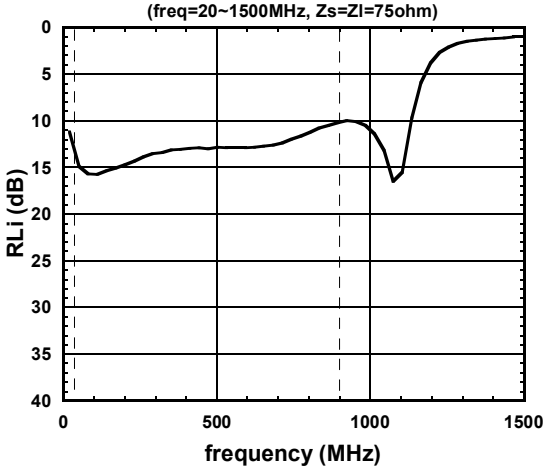
Gain vs. frequency
(freq=20~1500MHz, RF IN to RF OUT1, Zs=Zl=75ohm)



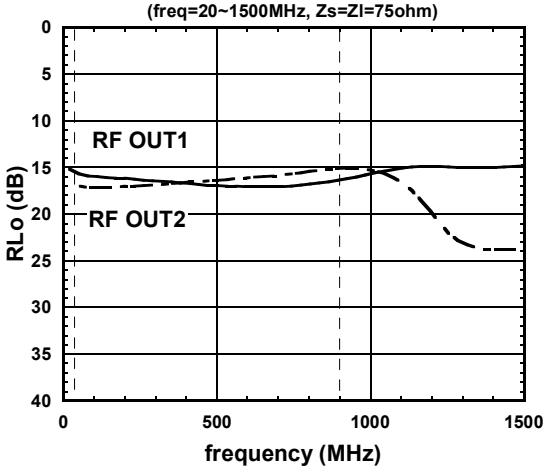
Gain vs. frequency
(freq=20~1500MHz, RF IN to RF OUT2, Zs=Zl=75ohm)



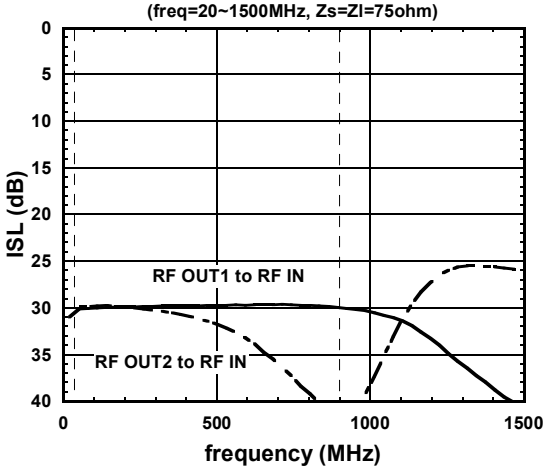
RF IN Return Loss vs. frequency
(freq=20~1500MHz, Zs=Zl=75ohm)



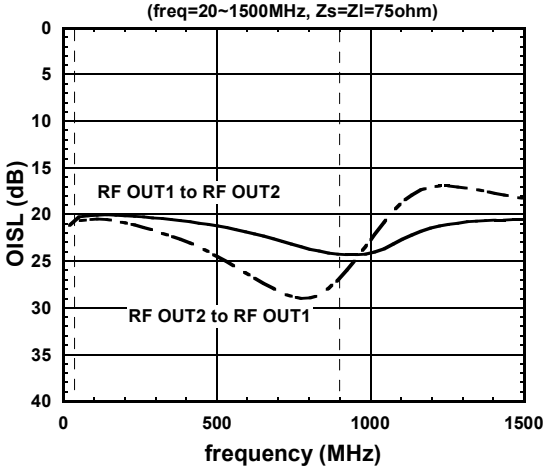
RF OUT Return Loss vs. frequency
(freq=20~1500MHz, Zs=Zl=75ohm)



Reverse Isolation vs. frequency
(freq=20~1500MHz, Zs=Zl=75ohm)

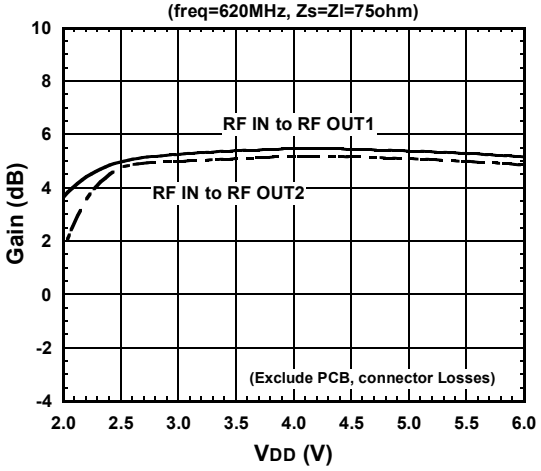


Output to Output Isolation vs. frequency
(freq=20~1500MHz, Zs=Zl=75ohm)

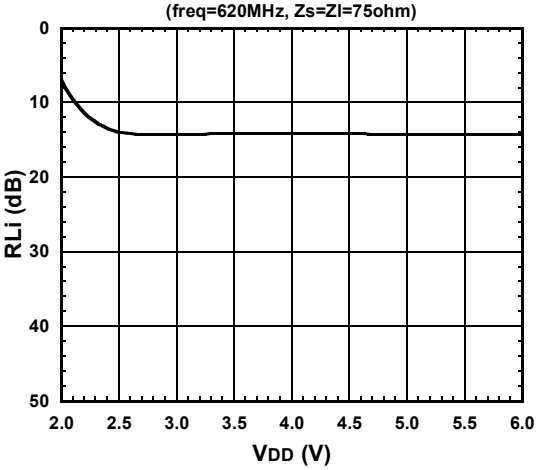


■ **ELECTRICAL CHARACTERISTICS** (Active mode, 75Ω)
Conditions: Ta=25°C, Z_s=Z_l=75Ω, with application circuit1

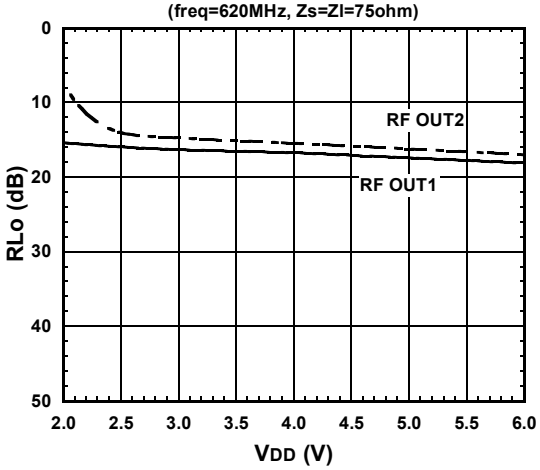
Gain vs. V_{DD}
(freq=620MHz, Zs=Zl=75ohm)



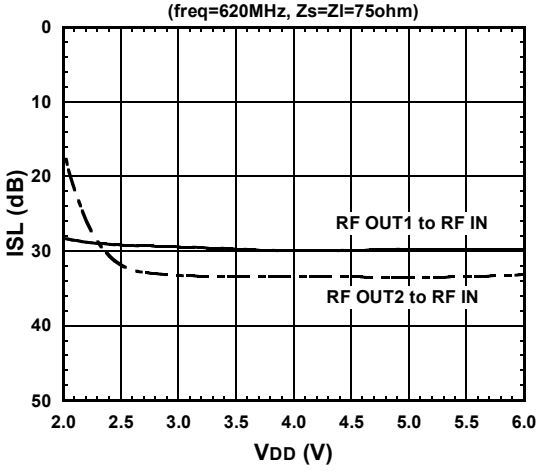
RF IN Return Loss vs. V_{DD}
(freq=620MHz, Zs=Zl=75ohm)



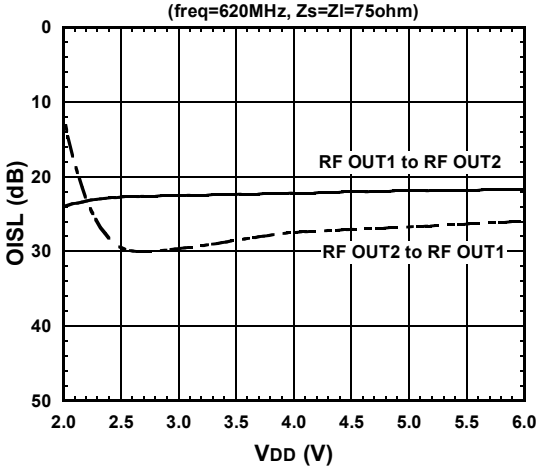
RF OUT Return Loss vs. V_{DD}
(freq=620MHz, Zs=Zl=75ohm)



Reverse Isolation vs. V_{DD}
(freq=620MHz, Zs=Zl=75ohm)

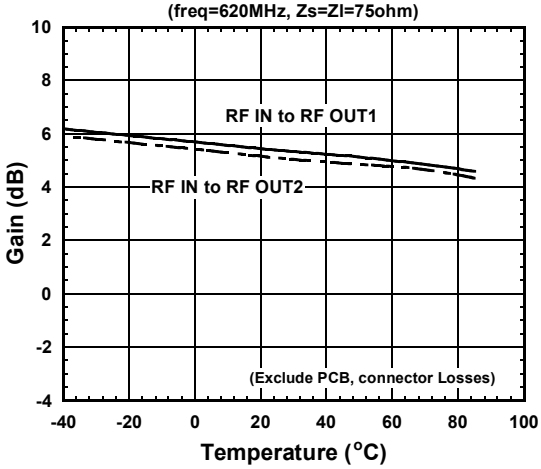


Output to Output Isolation vs. V_{DD}
(freq=620MHz, Zs=Zl=75ohm)

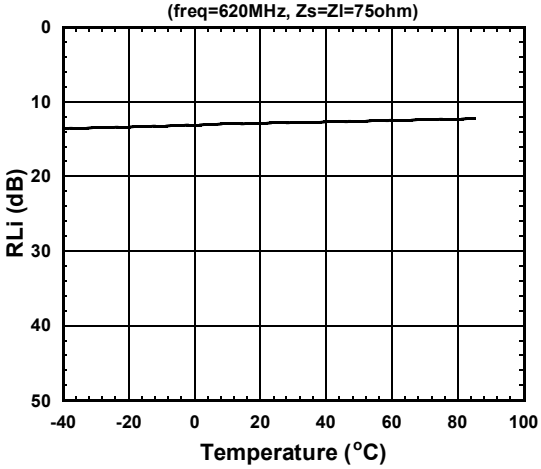


■ **ELECTRICAL CHARACTERISTICS** (Active mode, 75Ω)
Conditions: V_{DD}=5.0V, Z_s=Z_l=75Ω, with application circuit1

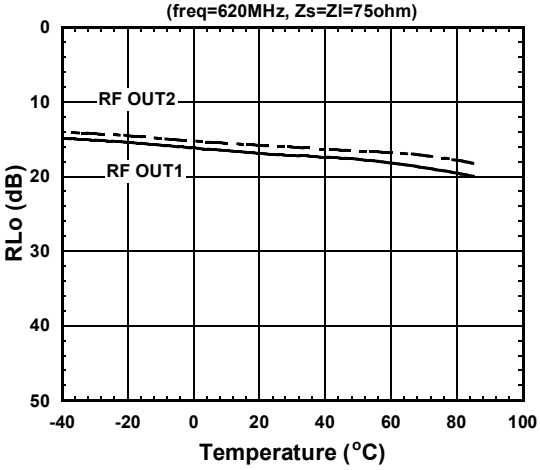
Gain vs. Temperature
(freq=620MHz, Zs=Zl=75ohm)



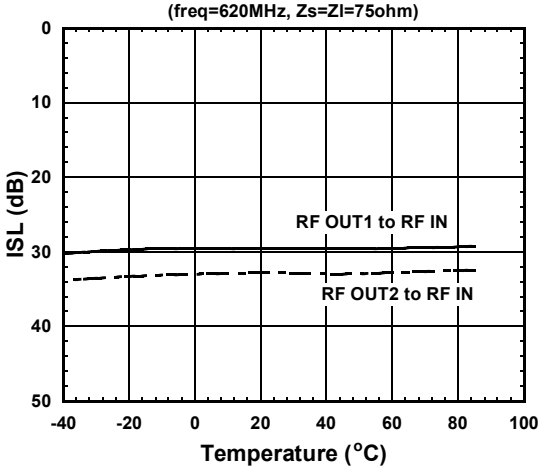
RF IN Return Loss vs. Temperature
(freq=620MHz, Zs=Zl=75ohm)



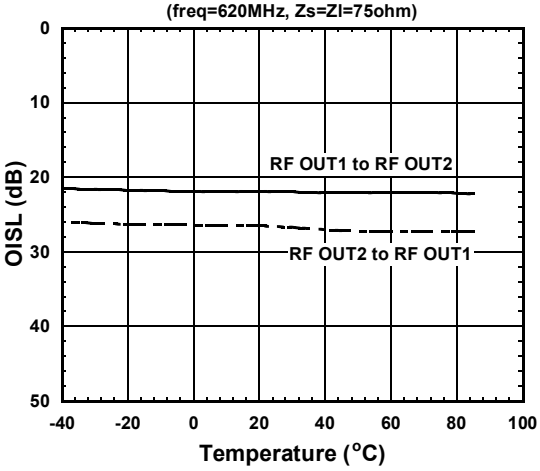
RF OUT Return Loss vs. Temperature
(freq=620MHz, Zs=Zl=75ohm)



Reverse Isolation vs. Temperature
(freq=620MHz, Zs=Zl=75ohm)



Output to Output Isolation vs. Temperature
(freq=620MHz, Zs=Zl=75ohm)

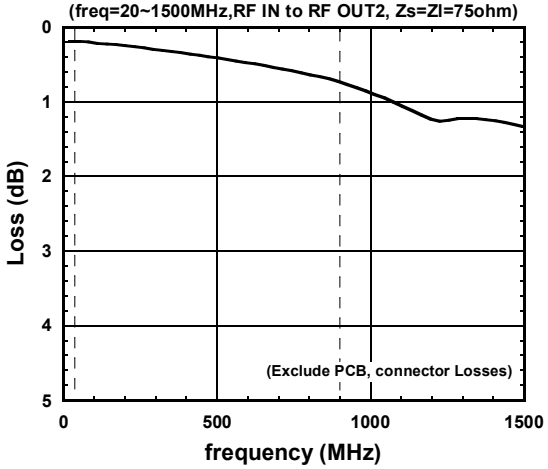


■ **ELECTRICAL CHARACTERISTICS** (Through mode, 75Ω)

Conditions: V_{DD}=0V, Ta=25°C, Z_s=Z_I=75Ω, with application circuit1

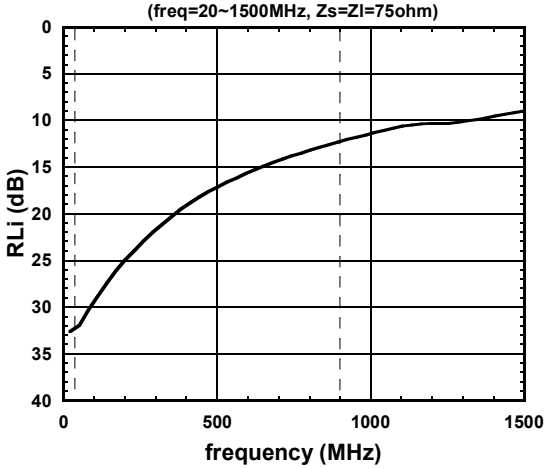
Insertion Loss vs. frequency

(freq=20~1500MHz,RF IN to RF OUT2, Zs=Zl=75ohm)



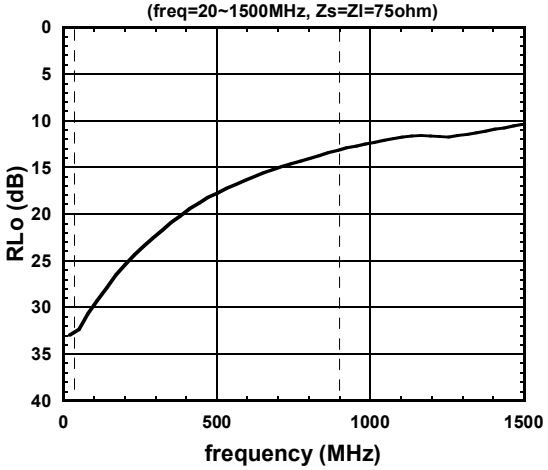
RF IN Return Loss vs. frequency

(freq=20~1500MHz, Zs=Zl=75ohm)



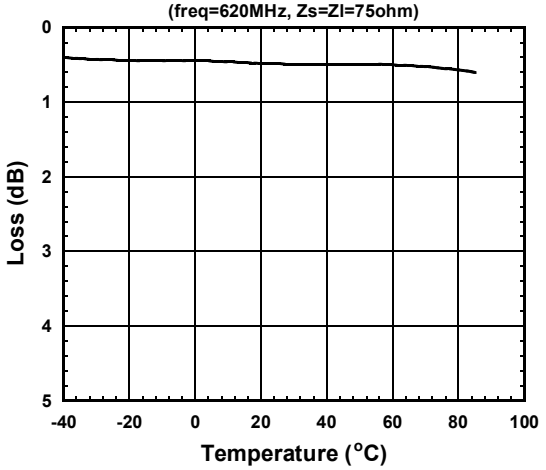
RF OUT2 Return Loss vs. frequency

(freq=20~1500MHz, Zs=Zl=75ohm)



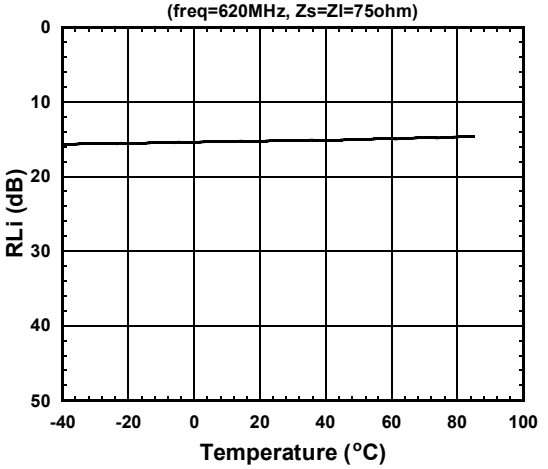
Insertion Loss vs. Temperature

(freq=620MHz, Zs=Zl=75ohm)



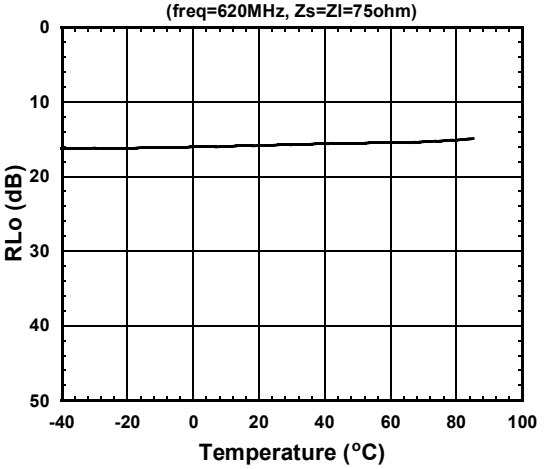
RF IN Return Loss vs. Temperature

(freq=620MHz, Zs=Zl=75ohm)

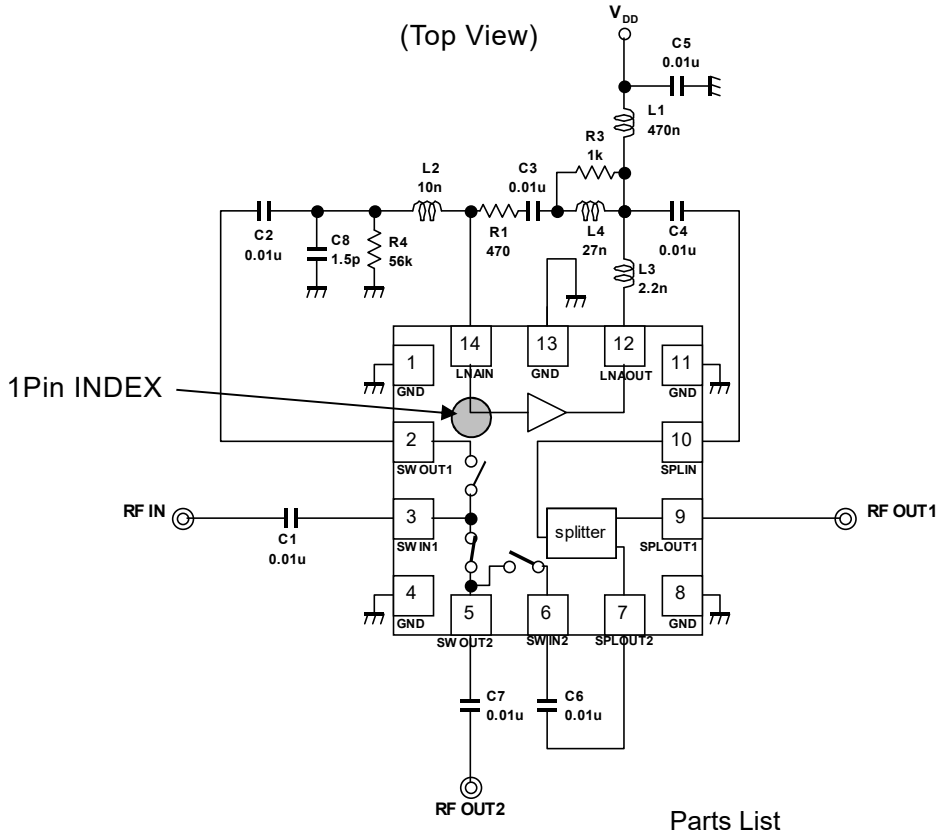


RF OUT Return Loss vs. Temperature

(freq=620MHz, Zs=Zl=75ohm)



■ APPLICATION CIRCUIT1: with through SW



Parts List

Parts ID	Manufacture
L1	TAIYO-YUDEN HK1608 Series
L2 to L4	TAIYO-YUDEN HK1005 Series
C1 to C5, C8	MURATA GRM15 Series
R1, R3, R4	KOA RK73 Series

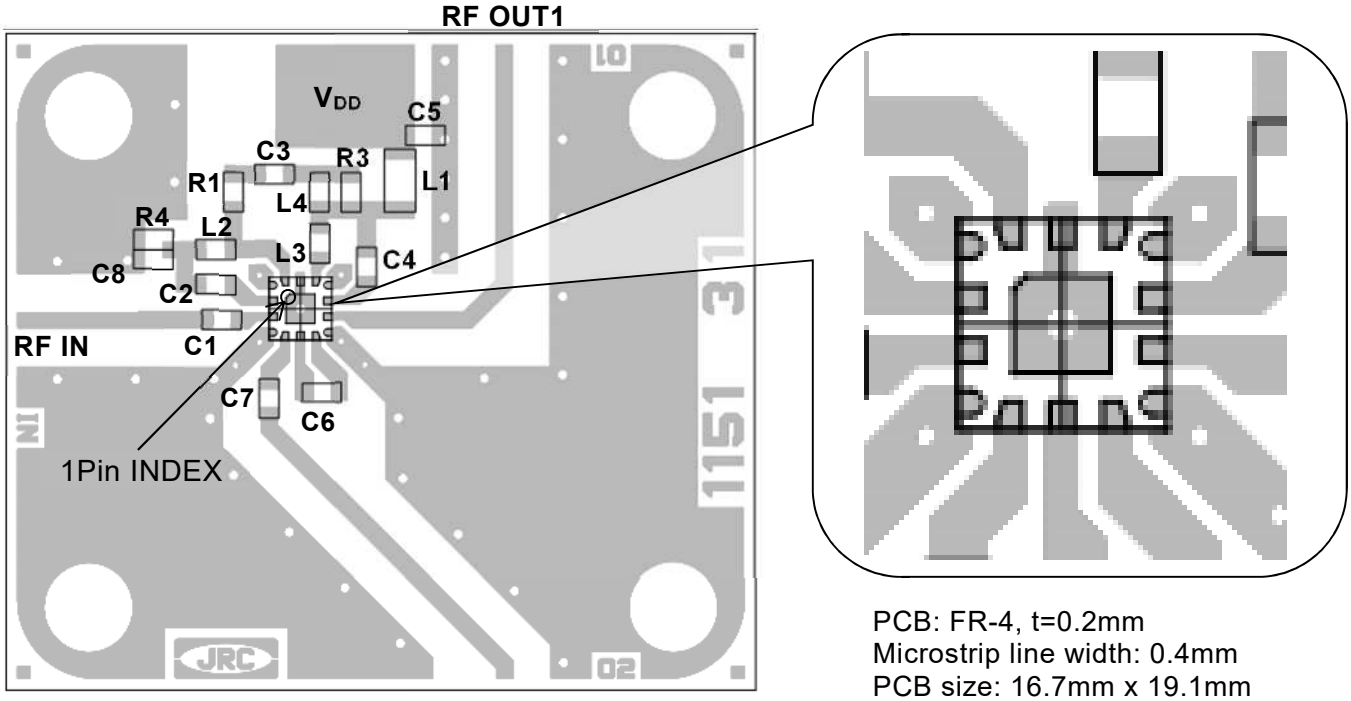
■ FUNCTION STATE TABLE1

Application circuit1: with through SW

V_{DD}	LNA	Loop through SW	RF IN to RF OUT1	RF IN to RF OUT2
0V	OFF	ON	Isolate mode (-28dB)	Through mode (-0.4dB)
5.0V	ON	OFF	Active mode (6dB)	Active mode (5.6dB)

■ TEST PCB LAYOUT

(Top View)



PRECAUTIONS

- C1 to C4, C6 and C7 are DC-Blocking capacitors, and C5 is a bypass capacitor.
- L1 is RF choke inductor. (DC feed inductor)
- R4 is the resistance to adjust the operating current.
- L2 to L4, R1, R3 and C8 are negative feedback circuit and impedance matching.
- All external parts, please be placed as close to the IC.
- The backside GND(exposed pad), because it is used to heat dissipation, please grounded by a lot of through-hole in small diameter or a through-hole in large diameter.

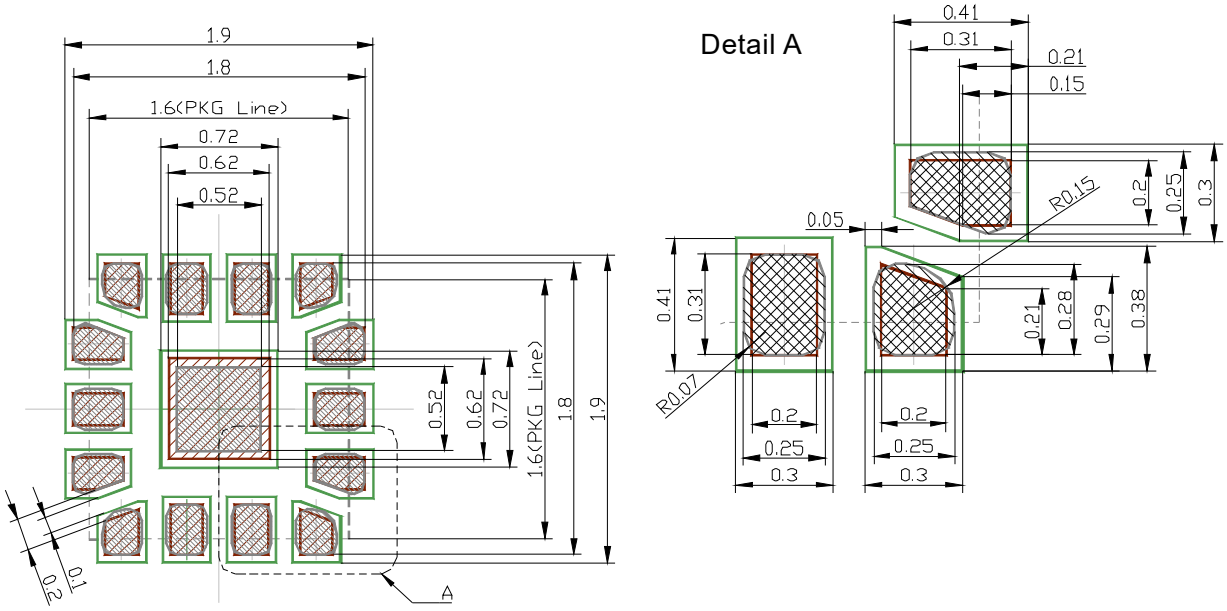
■ RECOMMENDED FOOTPRINT PATTERN (EQFN14-D7 PACKAGE Reference)

: Land

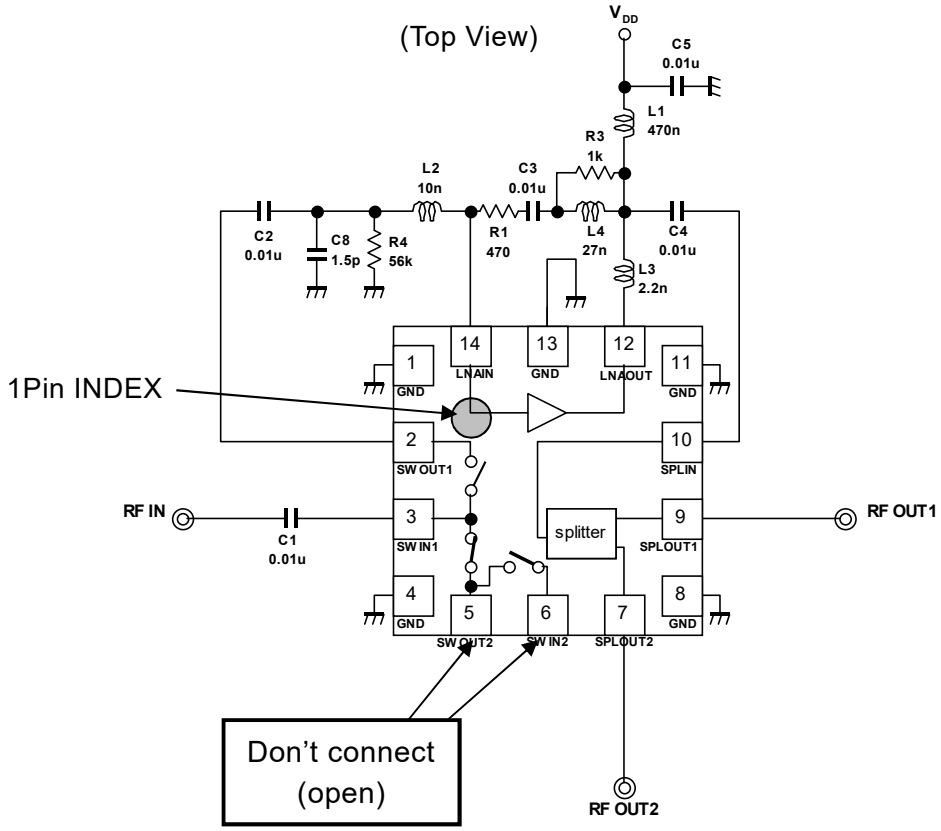
: Mask (Open area) *Metal mask thickness: 100μm

: Resist (Open area)

PKG: 1.6mm x 1.6mm
Pin pitch: 0.4mm



■ APPLICATION CIRCUIT2: without through SW



Parts List

Parts ID	Manufacture
L1	TAIYO-YUDEN HK1608 Series
L2 to L4	TAIYO-YUDEN HK1005 Series
C1 to C5, C8	MURATA GRM15 Series
R1, R3, R4	KOA RK73 Series

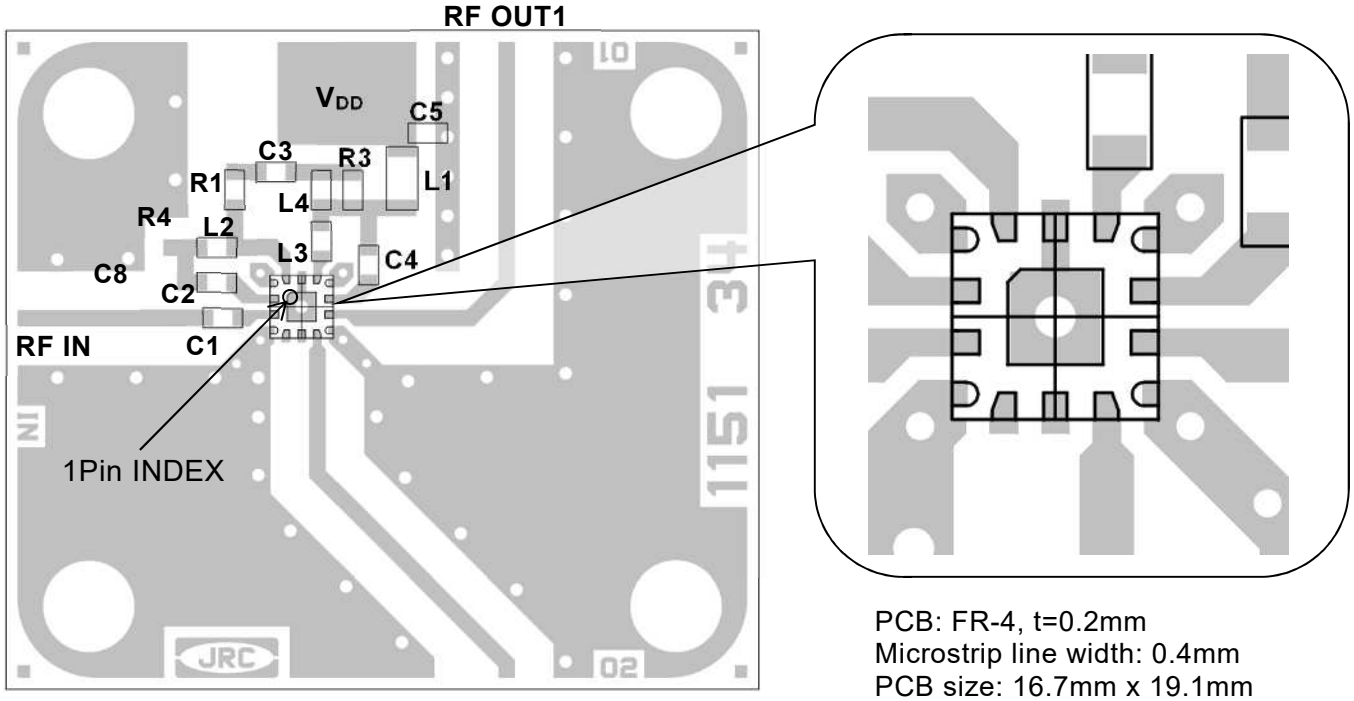
■ FUNCTION STATE TABLE2

Application circuit2: without through SW

V_{DD}	LNA	RF IN to RF OUT1	RF IN to RF OUT2
0V	OFF	Isolate mode (-28dB)	Isolate mode (-28dB)
5.0V	ON	Active mode (6dB)	Active mode (6dB)

■ TEST PCB LAYOUT2: without through SW

(Top View)



PCB: FR-4, t=0.2mm
Microstrip line width: 0.4mm
PCB size: 16.7mm x 19.1mm

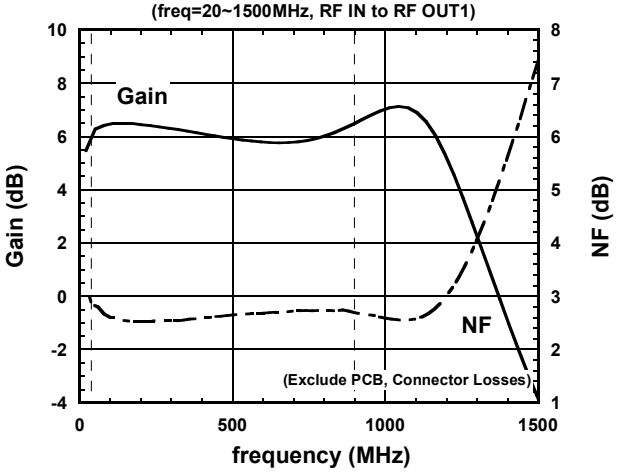
PRECAUTIONS

- C1 to C4 are DC-Blocking capacitors, and C5 is a bypass capacitor.
- L1 is RF choke inductor. (DC feed inductor)
- R4 is the resistance to adjust the operating current.
- L2 to L4, R1, R3 and C8 are negative feedback circuit and impedance matching.
- All external parts, please be placed as close to the IC.
- The backside GND(exposed pad), because it is used to heat dissipation, please grounded by a lot of through-hole in small diameter or a through-hole in large diameter.

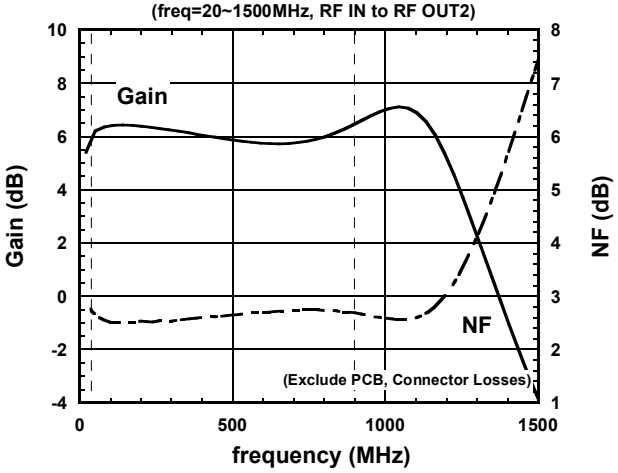
■ ELECTRICAL CHARACTERISTICS (Active mode, 50Ω)

Conditions: V_{DD}=5.0V, Z_s=Z_l=50Ω, with application circuit2

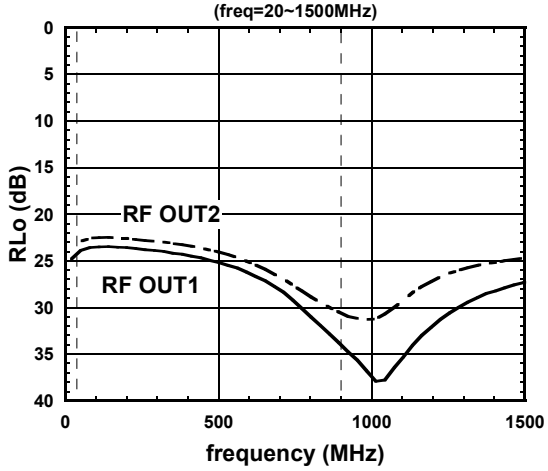
Gain, NF vs. frequency
(freq=20~1500MHz, RF IN to RF OUT1)



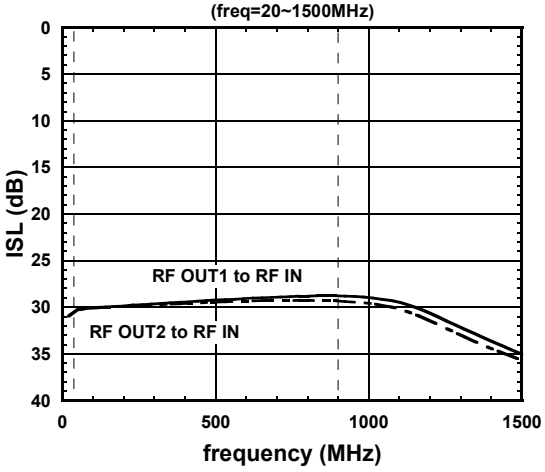
Gain, NF vs. frequency
(freq=20~1500MHz, RF IN to RF OUT2)



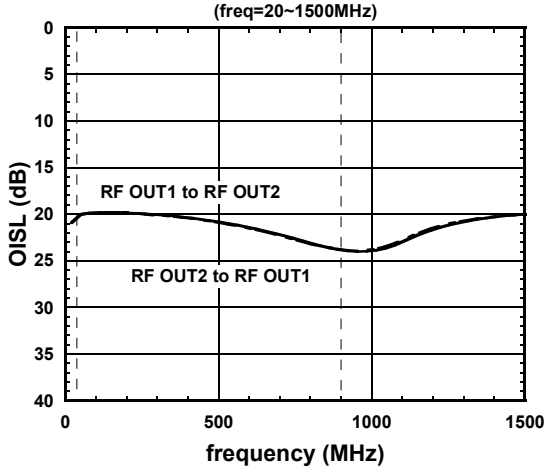
RF OUT Return Loss vs. frequency
(freq=20~1500MHz)



Reverse Isolation vs. frequency
(freq=20~1500MHz)



Output to Output Isolation vs. frequency
(freq=20~1500MHz)



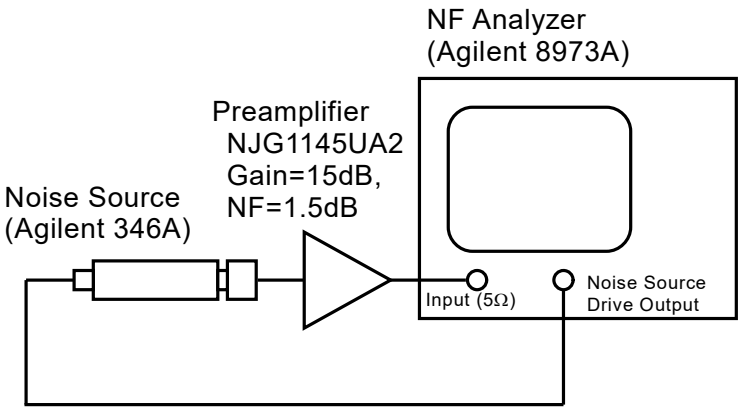
■ MEASUREMENT BLOCK DIAGRAM

Measuring instruments

NF Analyzer : Agilent 8973A
Noise Source : Agilent 346A

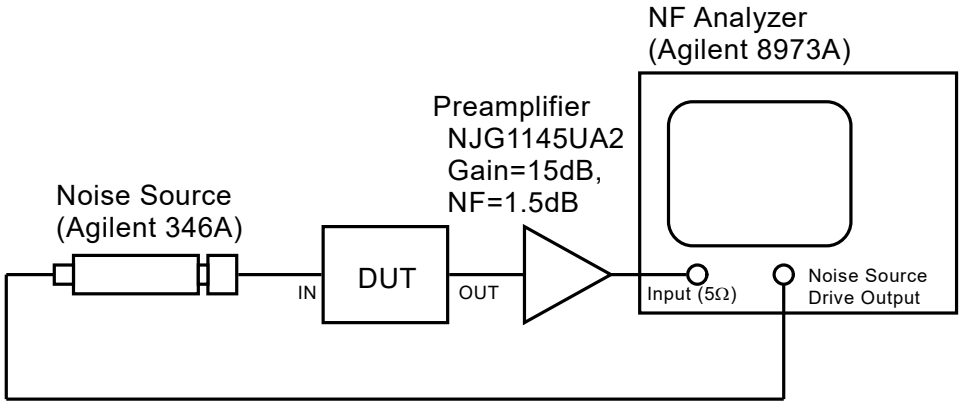
Setting the NF analyzer

Measurement mode form
Device under test : Amplifier
System downconverter : off
Mode setup form
Sideband : LSB
Averages : 4
Average mode : Point
Bandwidth : 4MHz
Loss comp : off
Tcold : setting the temperature of noise source (303K)



* Noise sauce, the preamplifier, and NF analyzer are connected directly.

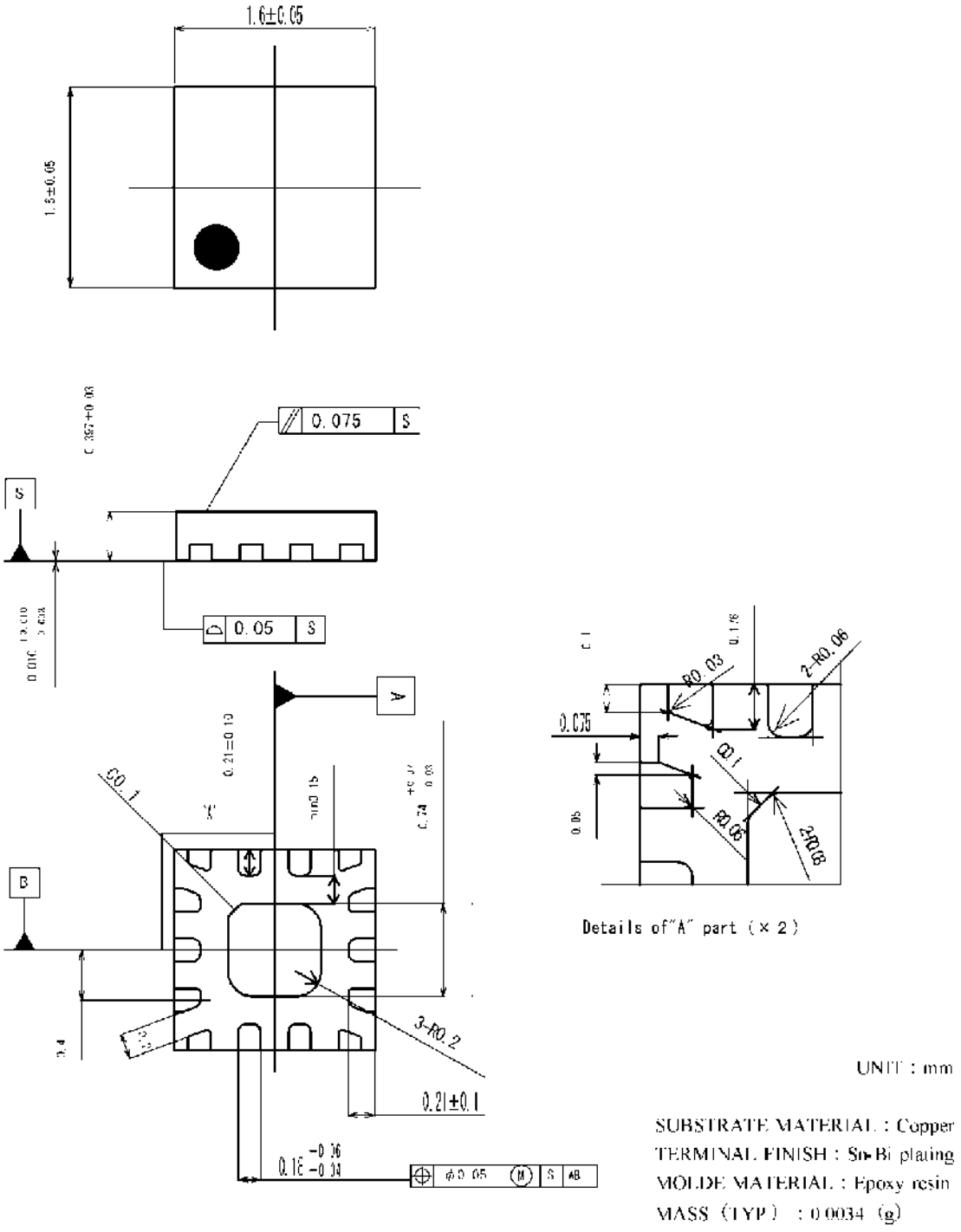
Calibration Setup



* Noise sauce, DUT, the preamplifier, and NF analyzer are connected directly.

Measurement Setup

■ PACKAGE OUTLINE (EQFN14-D7)



UNIT : mm

SUBSTRATE MATERIAL : Copper
TERMINAL FINISH : Sn-Bi plating
MOLDE MATERIAL : Epoxy resin
MASS (TYP.) : 0.0034 (g)

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]
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    - 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

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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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