2.4GHz Band SP3T Switch + LNA GaAs MMIC

■ GENERAL DESCRIPTION

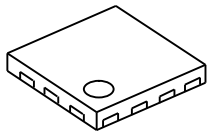
The NJG1730MD7 is a 2.4GHz band SP3T Switch + low noise amplifier GaAs MMIC designed for wireless LAN and Bluetooth front-end applications.

The NJG1730MD7 features low insertion loss of Transmit/Bluetooth path and high gain and low noise figure of RX LNA mode.

The NJG1730MD7 has ESD protection devices to achieve excellent ESD performances.

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

■ PACKAGE OUTLINE



NJG1730MD7

■ APPLICATIONS

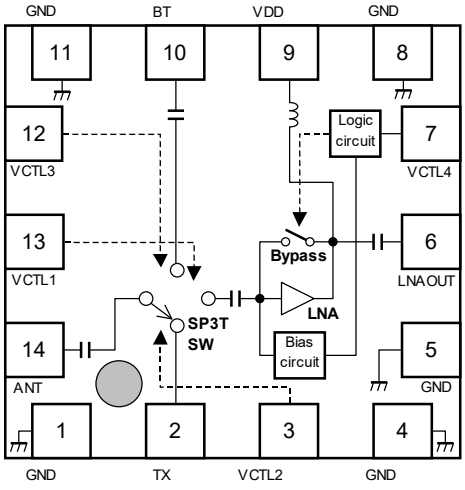
2.4GHz Band WLAN and Bluetooth front-end application

■ FEATURES

● Operating voltage	V_{DD}=3.6V typ.
● Operating frequency	freq=2400 to 2500MHz
[RX LNA mode]	
● Operating current	10mA typ. @V_{DD}=3.6V, V_{CTL}1=V_{CTL}4=3.3V, V_{CTL}2=V_{CTL}3=0V
● Small signal gain	15.0dB typ.
● Noise figure	1.6dB typ.
● Input power 1dB compression	-4dBm typ.
[RX Bypass mode]	
● Operating current	4μA typ. @V_{DD}=3.6V, V_{CTL}1=3.3V, V_{CTL}2=V_{CTL}3=V_{CTL}4=0V
● Input power 1dB compression	+9dBm typ.
[TX mode]	
● Insertion loss	0.5dB typ.
● Input power 0.1dB compression	+30dBm typ.
[BT mode]	
● Insertion loss	0.6dB typ.
● Input power 0.1dB compression	+26dBm typ.
● Package	EQFN14-D7 (Package size: 1.6mm x 1.6mm x 0.397mm typ.)
● RoHS compliant and Halogen Free, MSL1	

■ PIN CONFIGURATION

(Top view)



Pin Connection

1. GND	8. GND
2. TX	9. VDD
3. VCTL2	10. BT
4. GND	11. GND
5. GND	12. VCTL3
6. LNAOUT	13. VCTL1
7. VCTL4	14. ANT

Exposed Pad: GND

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

■ ABSOLUTE MAXIMUM RATINGS

Ta=+25°C

PARAMETERS	SYMBOL	CONDITIONS	RATINGS	UNITS
Supply voltage	V_{DD}		5.5	V
Control voltage	V_{CTL}		5.5	V
Input power 1	P_{IN1}	ANT terminal, V_{DD}=3.6V, V_{CTL}1=3.3V V_{CTL}2=V_{CTL}3=0V, V_{CTL}4=3.3/0V	+15	dBm
Input power 2	P_{IN2}	TX terminal, V_{DD}=3.6V, V_{CTL}2=3.3V V_{CTL}1=V_{CTL}3=V_{CTL}4=0V	+31	dBm
Input power 3	P_{IN3}	BT terminal, V_{DD}=3.6V, V_{CTL}3=3.3V V_{CTL}1=V_{CTL}2=V_{CTL}4=0V	+30	dBm
Power dissipation	P_D	Four-layer FR4 PCB with through-hole (76.2x114.3mm), Tj=150°C	1300	mW
Operation temperature	T_{opr}		-40 to +85	°C
Storage temperature	T_{stg}		-55 to +150	°C

■ ELECTRICAL CHARACTERISTICS 1 (DC Characteristics)

V_{DD}=3.6V, V_{CTL}(H)=3.3V, V_{CTL}(L)=0V, Ta=+25°C, Zs=Zl=50Ω

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply voltage	V_{DD}		3.0	3.6	5.0	V
Control voltage 1(High)	V_{CTL}1(H)		2.8	3.3	5.0	V
Control voltage 2(High)	V_{CTL}2(H)		2.8	3.3	5.0	V
Control voltage 3(High)	V_{CTL}3(H)		2.8	3.3	5.0	V
Control voltage 4(High)	V_{CTL}4(H)		2.8	3.3	5.0	V
Control voltage 1(Low)	V_{CTL}1(L)		0.0	-	0.4	V
Control voltage 2(Low)	V_{CTL}2(L)		0.0	-	0.4	V
Control voltage 3(Low)	V_{CTL}3(L)		0.0	-	0.4	V
Control voltage 4(Low)	V_{CTL}4(L)		0.0	-	0.4	V
LNA operating current 1 (RX LNA mode)	I_{DD}1	RF OFF, V_{CTL}1=V_{CTL}4=3.3V, V_{CTL}2=V_{CTL}3=0V	-	10	14	mA
LNA operating current 2 (RX Bypass mode)	I_{DD}2	RF OFF, V_{CTL}1=3.3V, V_{CTL}2=V_{CTL}3=V_{CTL}4=0V	-	4	15	μA
LNA operating current 3 (Sleep mode)	I_{DD}3	RF OFF, V_{CTL}1=V_{CTL}2=V_{CTL}3=V_{CTL}4=0.4V	-	4	15	μA
LNA operating current 4 (VCTL OPEN)	I_{DD}4	RF OFF, V_{CTL}1=V_{CTL}2=V_{CTL}3=V_{CTL}4=open	-	4	15	μA
Control current 1	I_{CTL}1	RF OFF, V_{CTL}1=3.3V, V_{CTL}2=V_{CTL}3=V_{CTL}4=0V	-	5	20	μA
Control current 2	I_{CTL}2	RF OFF, V_{CTL}2=3.3V, V_{CTL}1=V_{CTL}3=V_{CTL}4=0V	-	5	20	μA
Control current 3	I_{CTL}3	RF OFF, V_{CTL}3=3.3V, V_{CTL}1=V_{CTL}2=V_{CTL}4=0V	-	5	20	μA
Control current 4	I_{CTL}4	RF OFF, V_{CTL}4=3.3V, V_{CTL}1=V_{CTL}2=V_{CTL}3=0V	-	5	20	μA

■ **ELECTRICAL CHARACTERISTICS 2** (RF Characteristics: RX LNA mode, LNA+SP3T SW)

V_{DD}=3.6V, $V_{CTL}1$=$V_{CTL}4$=3.3V, $V_{CTL}2$=$V_{CTL}3$=0V, freq=2400 to 2500MHz, Ta=+25°C, Zs=Zl=50Ω, with application circuit

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small signal gain 1	Gain1	Exclude PCB and connector losses*1	13.0	15.0	17.0	dB
Gain flatness 1	Gflat1	f=2400 to 2420MHz, f=2440 to 2460MHz, f=2480 to 2500MHz	-	-	0.25	dB
Isolation 1	ISL1		-	28	-	dB
Noise figure 1	NF1	Exclude PCB and connector losses*2	-	1.6	1.9	dB
Input power at 1dB compression 1	$P_{-1dB(IN)}1$		-	-4	-	dBm
Input 3rd order Intercept point 1	IIP3_1	f1=freq, f2=freq+100kHz, P_{IN}=-22dBm	-	+7	-	dBm
ANT port return loss 1	RLi1		-	12	-	dB
LNAOUT port return loss 1	RLo1		-	10	-	dB
LNA switching time	Tsw1_1		-	100	400	ns
Other switching time	Tsw2_1		-	200	500	ns

*1) 0.36dB (2400MHz), 0.36dB (2450MHz), 0.37dB (2500MHz)
*2) 0.18dB (2400MHz), 0.18dB (2450MHz), 0.18dB (2500MHz)

■ **ELECTRICAL CHARACTERISTICS 3** (RF Characteristics: RX Bypass mode, Bypass SW+SP3T SW)

V_{DD}=3.6V, $V_{CTL}1$=3.3V, $V_{CTL}2$=$V_{CTL}3$=$V_{CTL}4$=0V, freq=2400 to 2500MHz, Ta=+25°C, Zs=Zl=50Ω, with application circuit

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Insertion loss 2	LOSS2	Exclude PCB and connector losses*3	4.0	6.0	8.0	dB
Input power at 1dB compression 2	$P_{-1dB(IN)}2$		-	+9	-	dBm
Input 3rd order Intercept point 2	IIP3_2	f1=freq, f2=freq+100kHz, P_{IN}=-14dBm	-	+13	-	dBm
ANT port return loss 2	RLi2		-	7	-	dB
LNAOUT port return loss 2	RLo2		-	7	-	dB

*3) 0.36dB (2400MHz), 0.36dB (2450MHz), 0.37dB (2500MHz)

■ **ELECTRICAL CHARACTERISTICS 4** (RF Characteristics: TX mode)

V_{DD}=3.6V, $V_{CTL}2$=3.3V, $V_{CTL}1$=$V_{CTL}3$=$V_{CTL}4$=0V, freq=2400 to 2500MHz, Ta=+25°C, Zs=Zl=50Ω, with application circuit

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Insertion loss 3	LOSS3	P_{IN}=+23dBm, Exclude PCB and connector losses*4	-	0.5	0.7	dB
Input power at 0.1dB compression 3	$P_{-0.1dB(IN)}3$		-	+30	-	dBm
ANT port return loss 3	RLi3		-	22	-	dB
TX port return loss 3	RLo3		-	22	-	dB

*4) 0.34dB (2400MHz), 0.35dB (2450MHz), 0.36dB (2500MHz)

■ **ELECTRICAL CHARACTERISTICS 5** (RF Characteristics: BT mode)

V_{DD}=3.6V, $V_{CTL}3$=3.3V, $V_{CTL}1$=$V_{CTL}2$=$V_{CTL}4$=0V, freq=2400 to 2500MHz, Ta=+25°C, Zs=Zl=50Ω, with application circuit

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Insertion loss 4	LOSS4	P_{IN}=+20dBm, Exclude PCB and connector losses*5	-	0.6	0.8	dB
Input power at 0.1dB compression 4	$P_{-0.1dB(IN)}4$		-	+26	-	dBm
ANT port return loss 4	RLi4		-	22	-	dB
BT port return loss 4	RLo4		-	22	-	dB

*5) 0.70dB (2400MHz), 0.72dB (2450MHz), 0.73dB (2500MHz)

■ **ELECTRICAL CHARACTERISTICS 6** (RF Characteristics)

V_{DD}=3.6V, $V_{CTL}1$=3.3V, $V_{CTL}2$=$V_{CTL}3$=0V, $V_{CTL}4$=3.3/0V, freq=2400 to 2500MHz, Ta=+25°C, Zs=Zl=50Ω, with application circuit

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Gain dynamic range	GDR	Gain1+LOSS2	18.0	21.0	24.0	dB

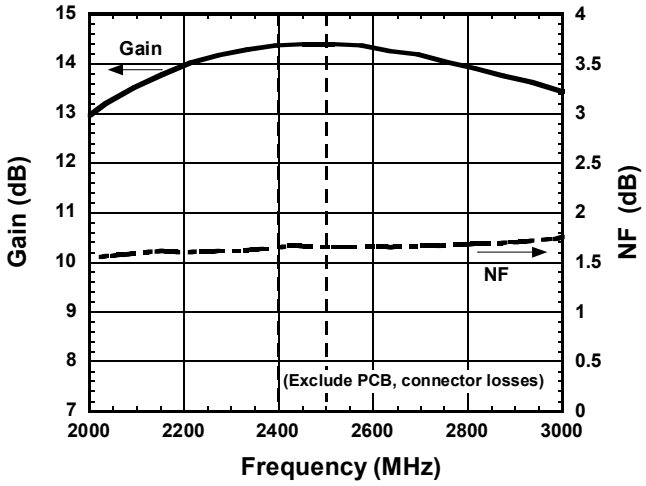
■ TERMINAL INFORMATION

Pin No.	SYMBOL	DESCRIPTION
1	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.
2	TX	RF transmitting signal input terminal. DC blocking capacitor is required for this port.
3	VCTL2	Control signal input terminal. This terminal is set to High-Level (+2.8 to +5.0V) or Low-Level (0 to +0.4V).
4	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.
5	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.
6	LNAOUT	RF receiving signal output terminal. No DC blocking capacitor is required for this port because of internal output matching circuit including DC blocking capacitor.
7	VCTL4	Control signal input terminal. This terminal is set to High-Level (+2.8 to +5.0V) or Low-Level (0 to +0.4V).
8	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.
9	VDD	Positive voltage supply terminal. The positive voltage (+3.0 to +5.0V) has to be supplied. Please connect a bypass capacitor with GND terminal for excellent RF performance.
10	BT	Bluetooth terminal. No DC blocking capacitor is required for this port because of internal capacitor.
11	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.
12	VCTL3	Control signal input terminal. This terminal is set to High-Level (+2.8 to +5.0V) or Low-Level (0 to +0.4V).
13	VCTL1	Control signal input terminal. This terminal is set to High-Level (+2.8 to +5.0V) or Low-Level (0 to +0.4V).
14	ANT	RF transmitting/receiving terminal. No DC blocking capacitor is required for this port because of internal capacitor.
Exposed Pad	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance, and through holes for GND should be placed near by the pin connection

■ **ELECTRICAL CHARACTERISTICS** (RX LNA mode)

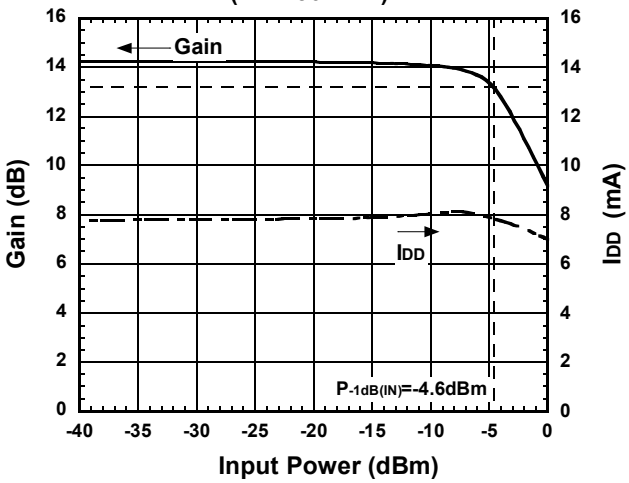
V_{DD}=3.6V, $V_{CTL}1$=$V_{CTL}4$=3.3V, $V_{CTL}2$=$V_{CTL}3$=0V, Ta=25ºC, Zs=Zl=50Ω

Gain, NF vs. Frequency

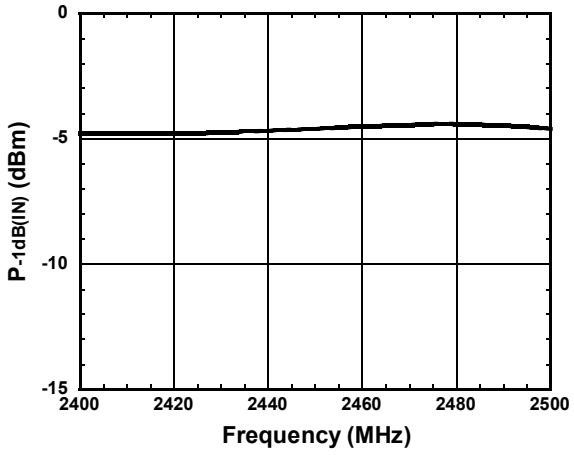


Gain, IDD vs. PIN

(f=2450MHz)

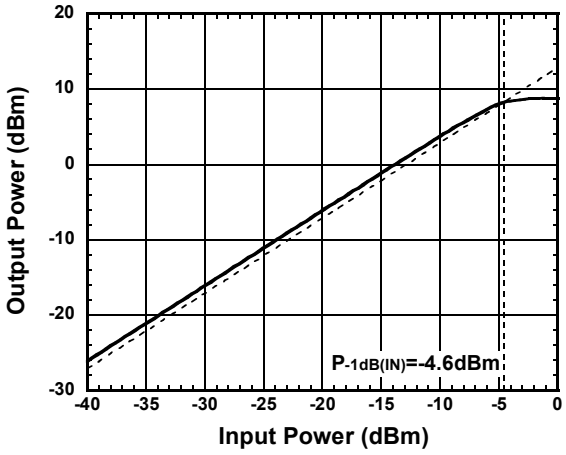


P-1dB(IN) vs. Frequency



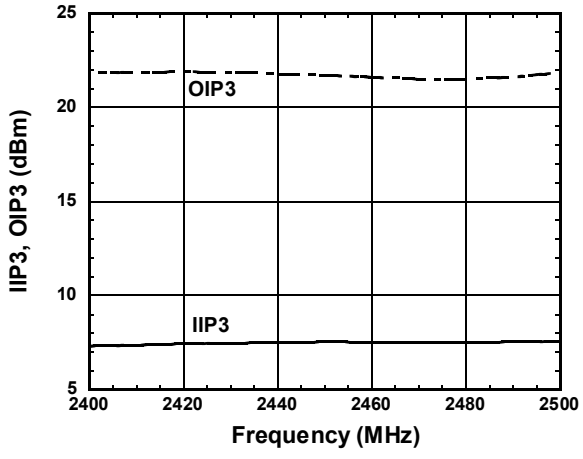
POUT vs. PIN

(f=2450MHz)



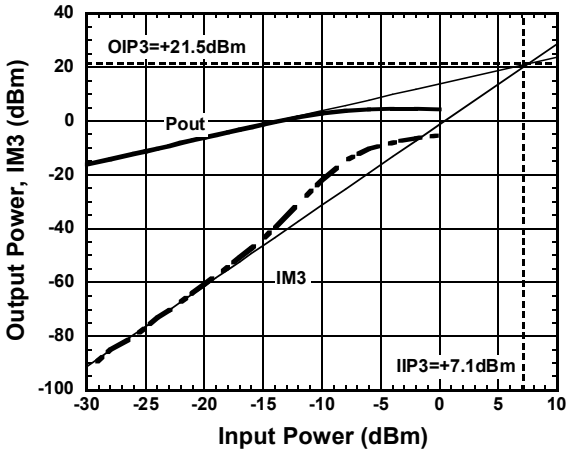
IIP3, OIP3 vs. Frequency

(f1=2400~2500MHz, f2=f1+100kHz, Pin=-22dBm)



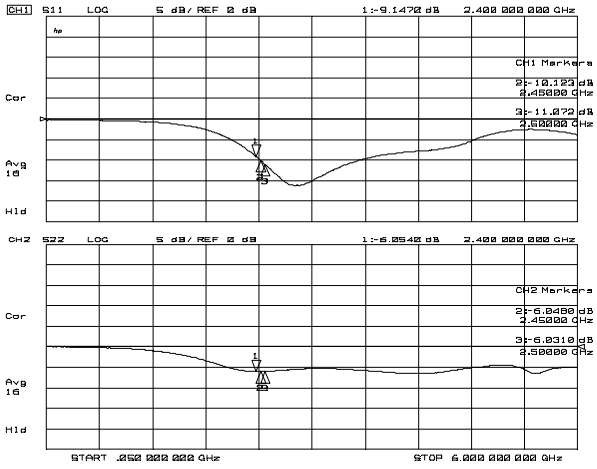
POUT, IM3 vs. PIN

(f1=2450MHz, f2=2450.1MHz)

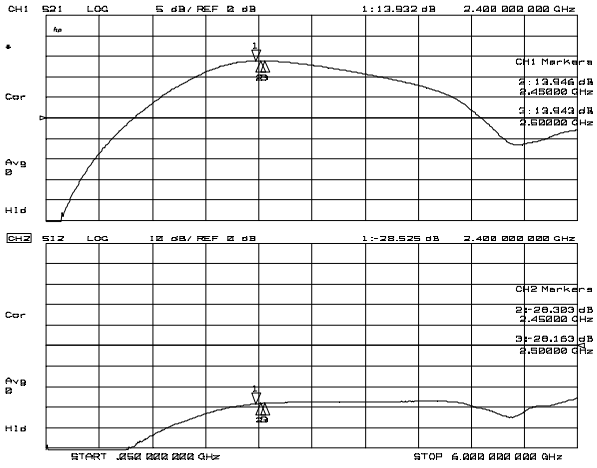


■ ELECTRICAL CHARACTERISTICS (RX LNA mode)

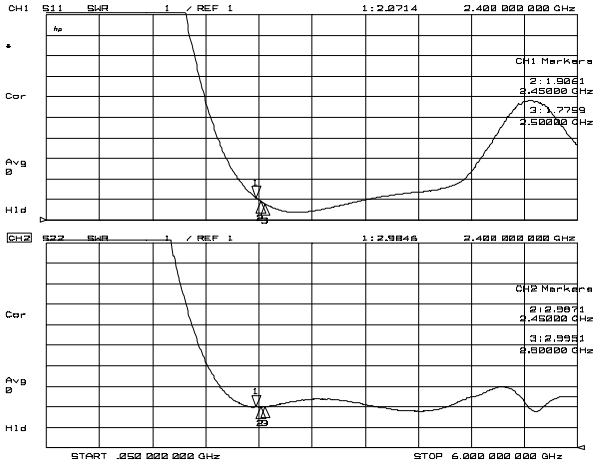
V_{DD}=3.6V, $V_{CTL}1$=$V_{CTL}4$=3.3V, $V_{CTL}2$=$V_{CTL}3$=0V, Ta=25ºC, Zs=Zl=50Ω



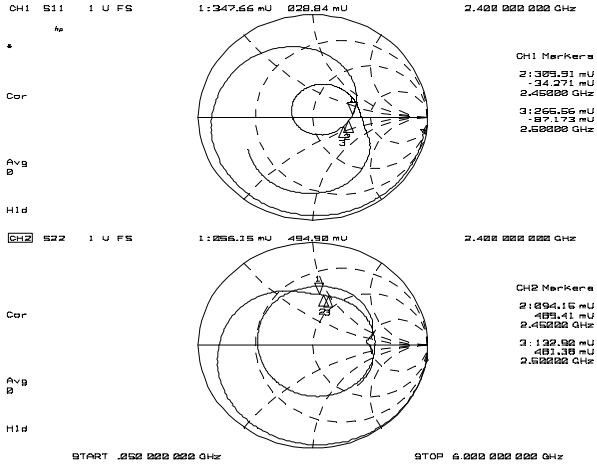
S11, S22 (f=50MHz to 6GHz)



S21, S12 (f=50MHz to 6GHz)



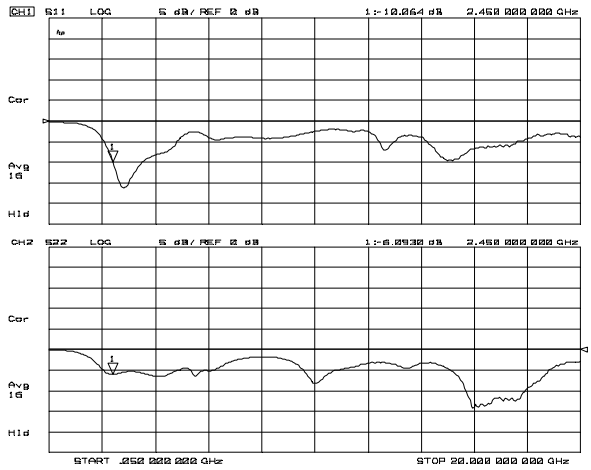
VSWRi, VSWRo (f=50MHz to 6GHz)



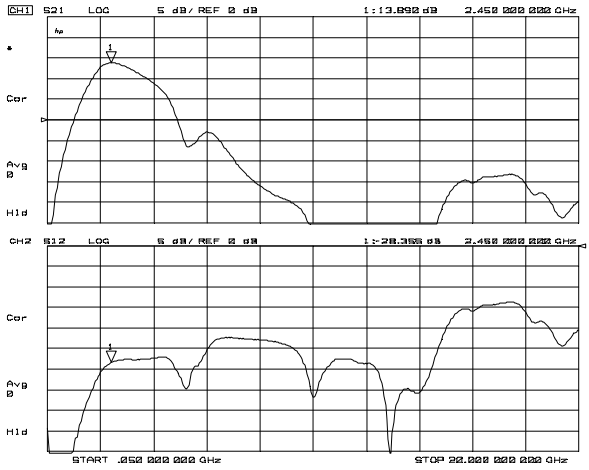
Zin, Zout (f=50MHz to 6GHz)

■ **ELECTRICAL CHARACTERISTICS** (RX LNA mode)

V_{DD}=3.6V, $V_{CTL}1$=$V_{CTL}4$=3.3V, $V_{CTL}2$=$V_{CTL}3$=0V, Ta=25°C, Zs=Zl=50Ω



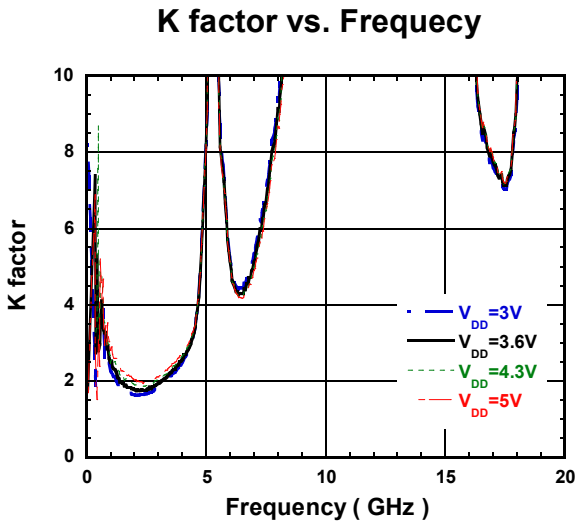
S11, S22 (f=50MHz to 20GHz)



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

■ **ELECTRICAL CHARACTERISTICS** (RX LNA mode)

$V_{CTL}1$=$V_{CTL}4$=3.3V, $V_{CTL}2$=$V_{CTL}3$=0V, Ta=25°C, Zs=Zl=50Ω

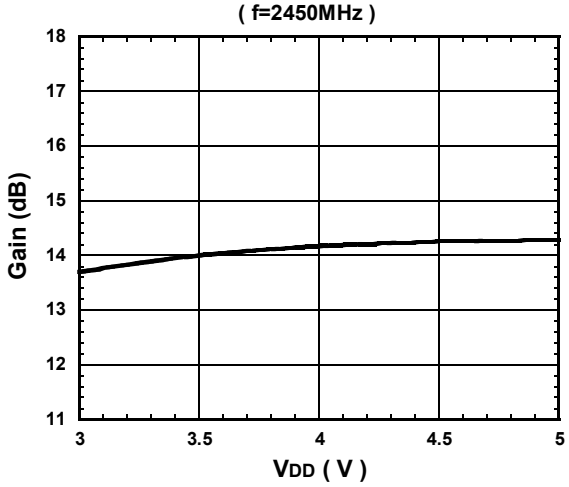


■ ELECTRICAL CHARACTERISTICS (RX LNA mode)

$V_{CTL}1=V_{CTL}4=3.3V$, $V_{CTL}2=V_{CTL}3=0V$, Ta=25°C, Zs=Zl=50Ω

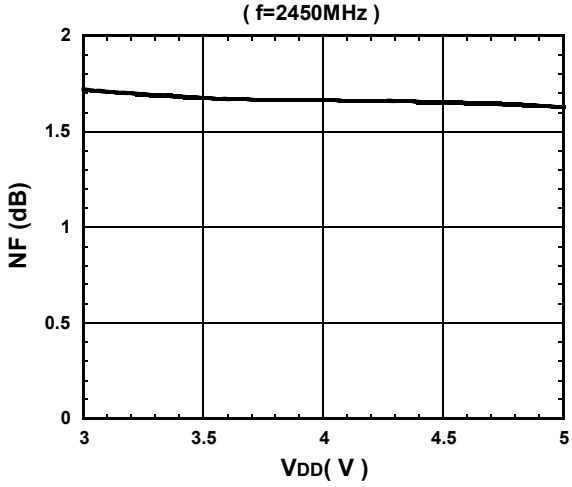
Gain vs. V_{DD}

(f=2450MHz)

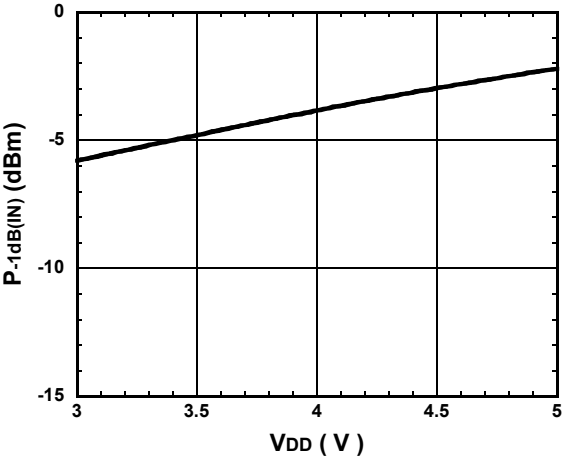


NF vs. V_{DD}

(f=2450MHz)

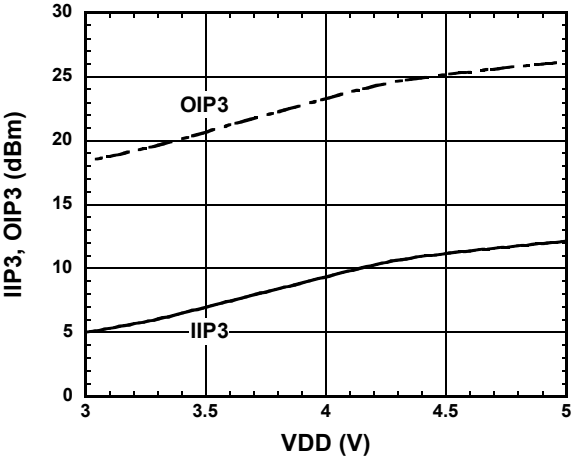


$P_{-1dB(IN)}$ vs. V_{DD}



IIP3, OIP3 vs. V_{DD}

(f1=2450MHz, f2=2450.1MHz, Pin=-22dBm)

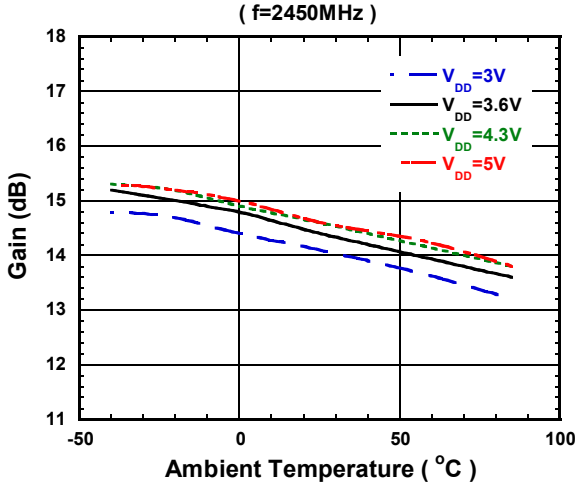


■ ELECTRICAL CHARACTERISTICS (RX LNA mode)

$V_{CTL}1=V_{CTL}4=3.3V$, $V_{CTL}2=V_{CTL}3=0V$, Zs=Zl=50Ω

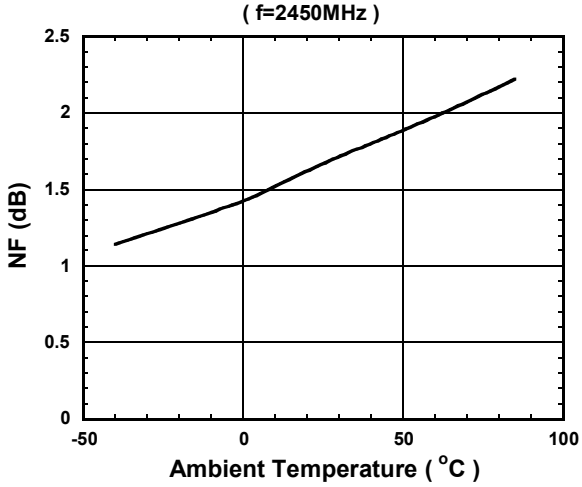
Gain vs. Ambient Temperature

(f=2450MHz)



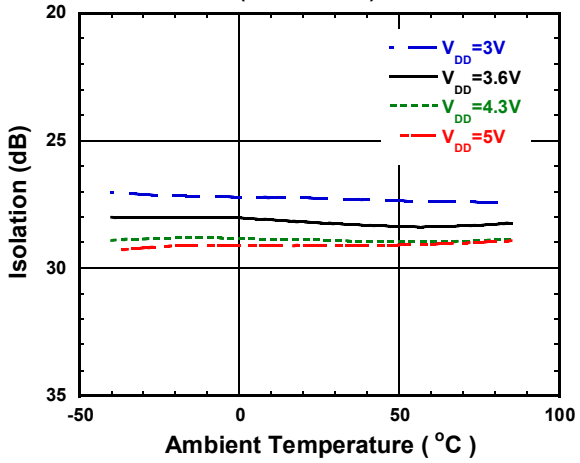
NF vs. Ambient Temperature

(f=2450MHz)



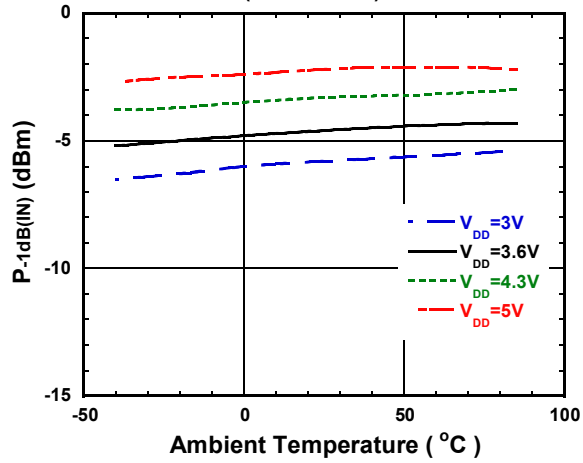
Reverse Isolation vs. Ambient Temperature

(f=2450MHz)



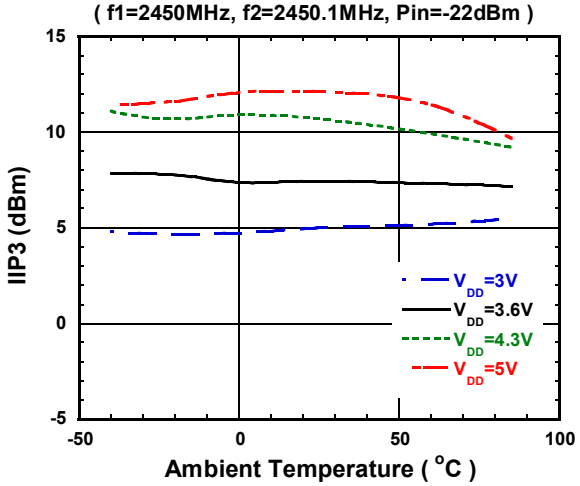
P-1dB(IN) vs. Ambient Temperature

(f=2450MHz)



IIP3 vs. Ambient Temperature

(f1=2450MHz, f2=2450.1MHz, Pin=-22dBm)

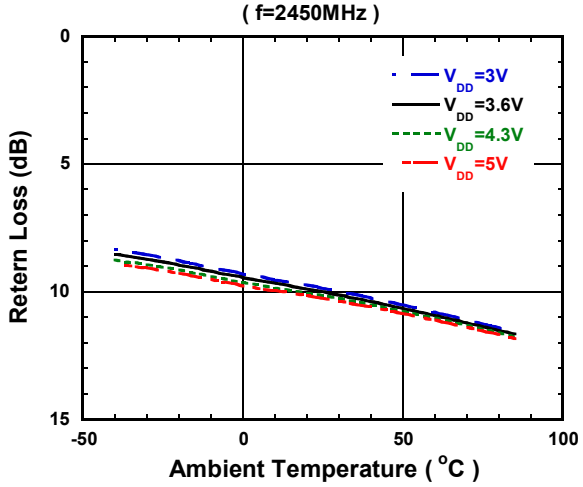


■ ELECTRICAL CHARACTERISTICS (RX LNA mode)

$V_{CTL}1=V_{CTL}4=3.3V$, $V_{CTL}2=V_{CTL}3=0V$, Zs=Zl=50Ω

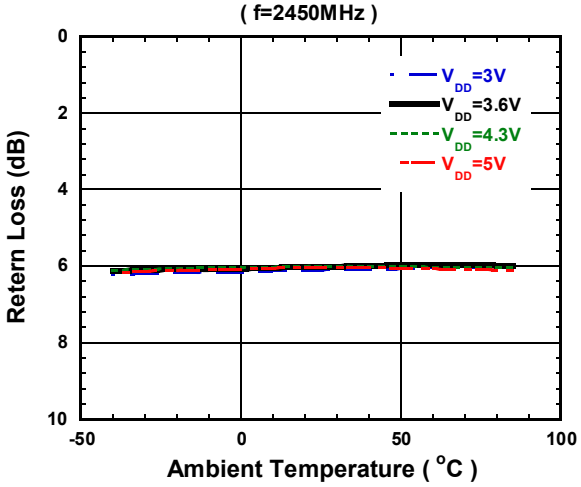
ANT Port Return Loss vs. Ambient Temperature

(f=2450MHz)



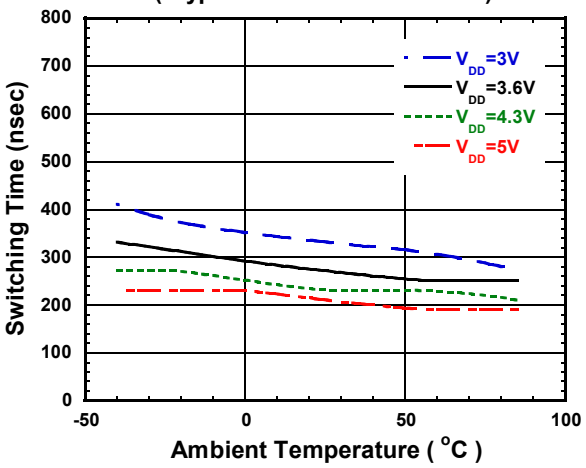
LNAOUT Port Return Loss vs. Ambient Temperature

(f=2450MHz)



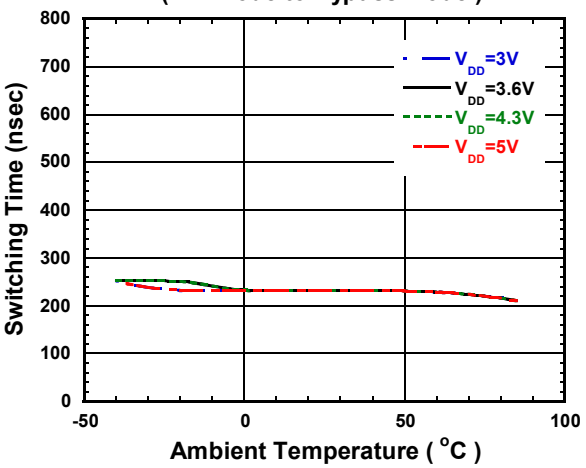
Switching Time vs. Ambient Temperature

(Bypass Mode to LNA Mode)



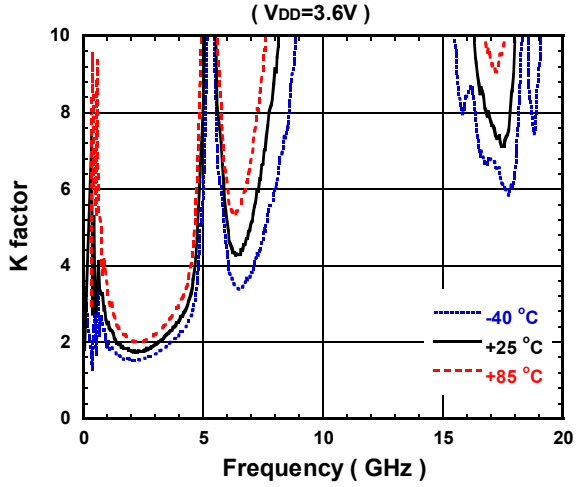
Switching Time vs. Ambient Temperature

(TX mode to Bypass Mode)



K factor vs. Frequency

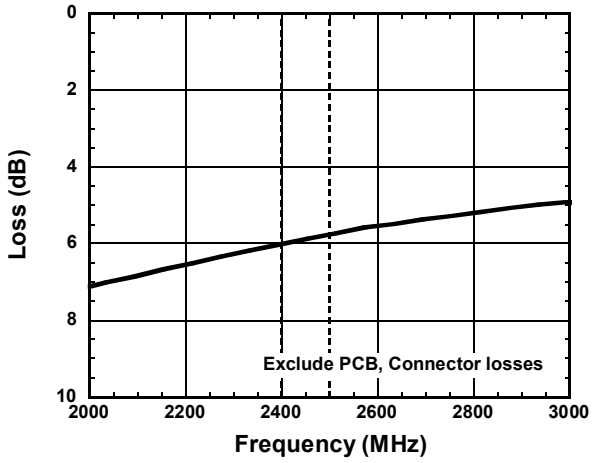
(VDD=3.6V)



■ **ELECTRICAL CHARACTERISTICS** (RX Bypass mode)

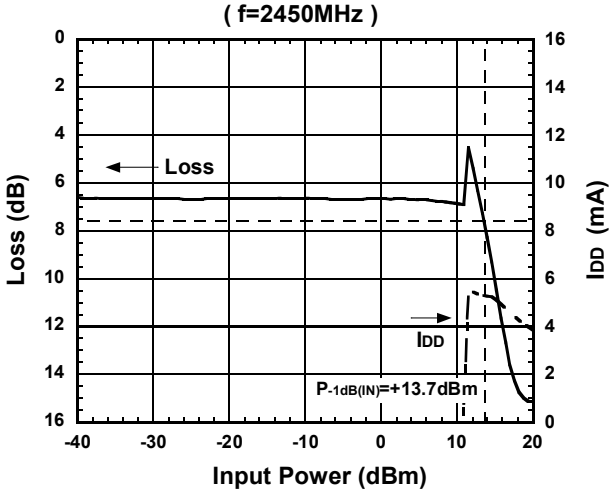
V_{DD}=3.6V, V_{CTL}1=3.3V, V_{CTL}2=V_{CTL}3=V_{CTL}4=0V, Ta=25ºC, Zs=Zl=50Ω

Loss vs. Frequency

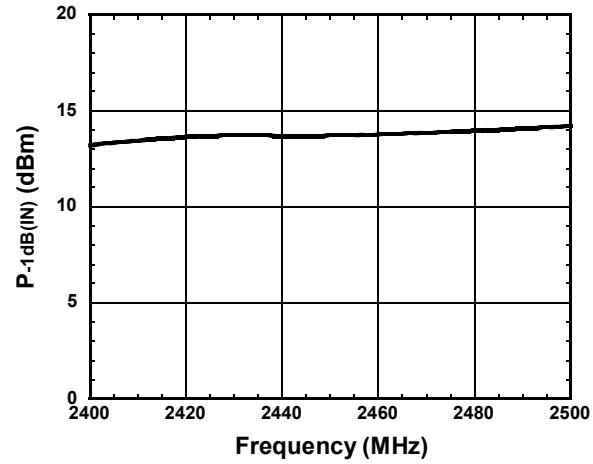


Loss, IDD vs. PIN

(f=2450MHz)

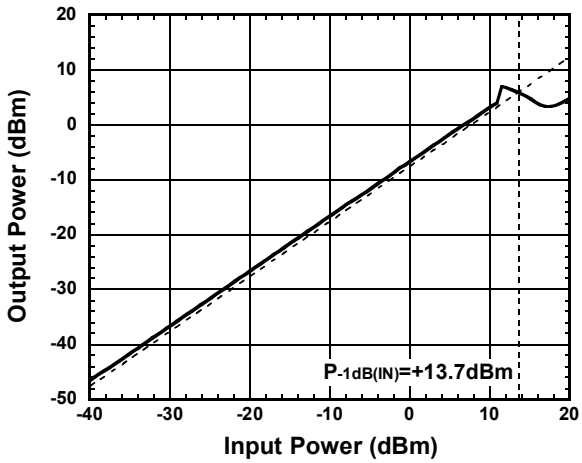


P-1dB(IN) vs. Frequency



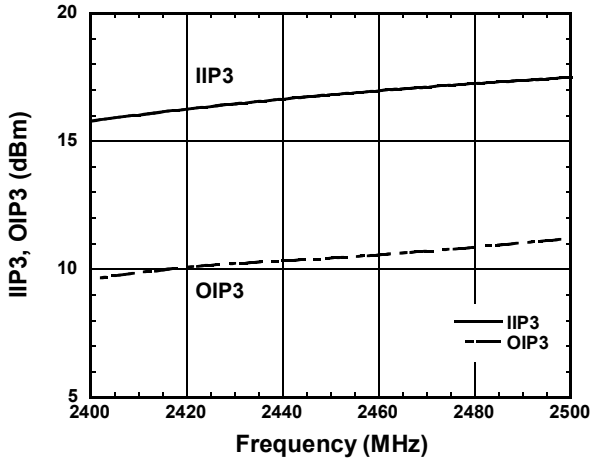
POUT vs. PIN

(f=2450MHz)



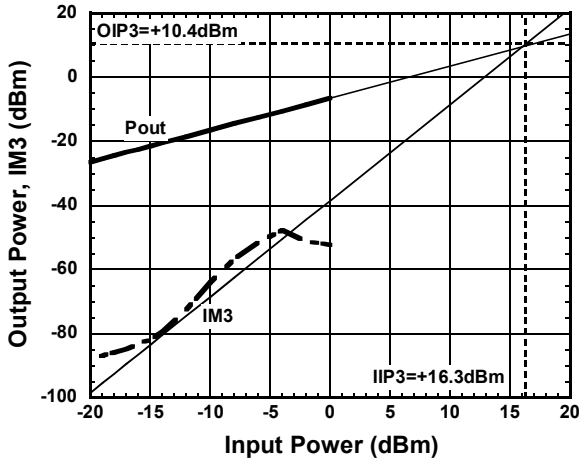
IIP3, OIP3 vs. Frequency

(f1=2400~2500MHz, f2=f1+100kHz, Pin=-14dBm)



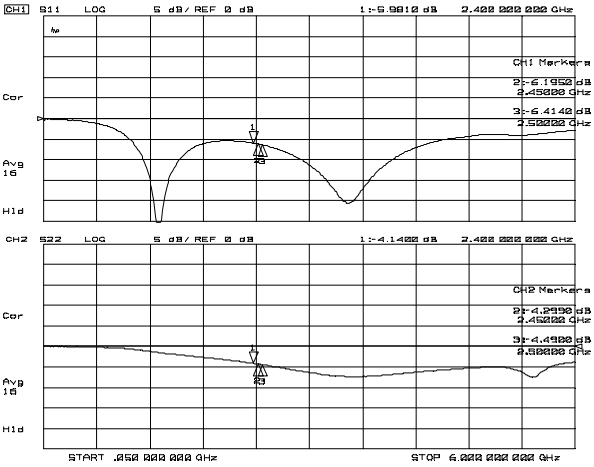
POUT, IM3 vs. PIN

(f1=2450MHz, f2=2450.1MHz)

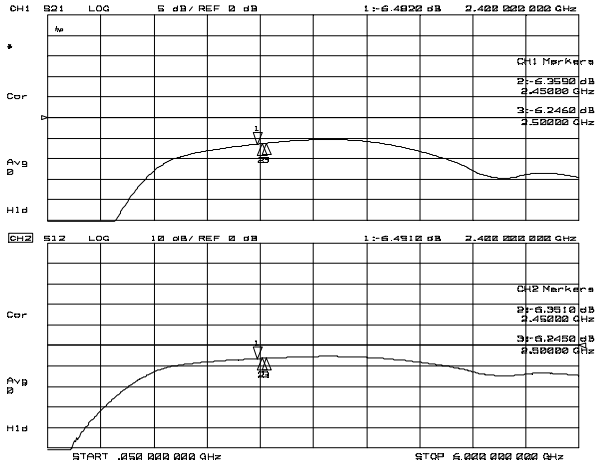


■ **ELECTRICAL CHARACTERISTICS** (RX Bypass mode)

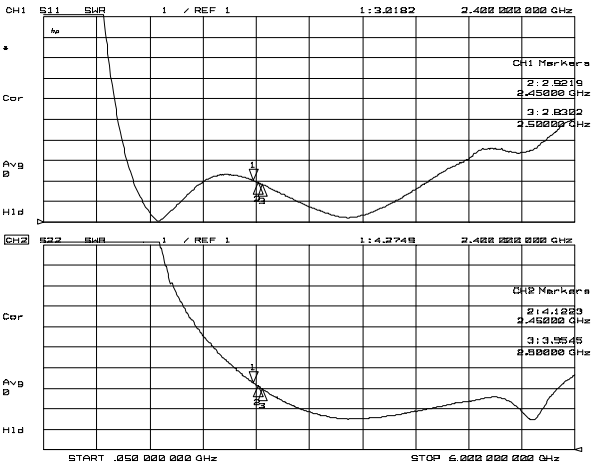
V_{DD}=3.6V, V_{CTL}1=3.3V, V_{CTL}2=V_{CTL}3=V_{CTL}4=0V, Ta=25°C, Zs=Zl=50Ω



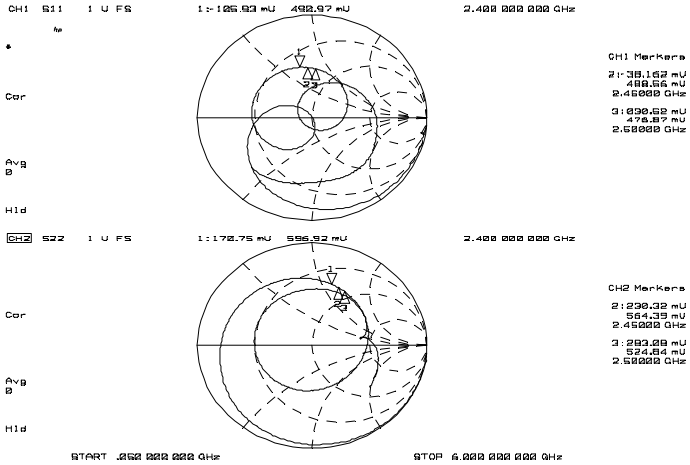
S11, S22 (f=50MHz to 6GHz)



S21, S12 (f=50MHz to 6GHz)



VSWRi, VSWRo (f=50MHz to 6GHz)



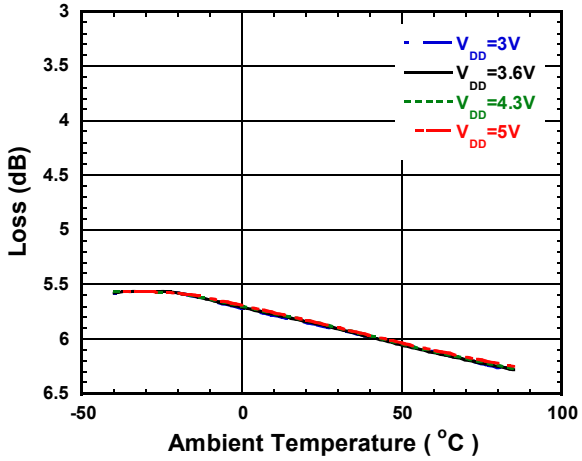
Zin, Zout (f=50MHz to 6GHz)

■ ELECTRICAL CHARACTERISTICS (RX Bypass mode)

$V_{CTL}1$=3.3V, $V_{CTL}2$=$V_{CTL}3$=$V_{CTL}4$=0V, Zs=Zl=50Ω

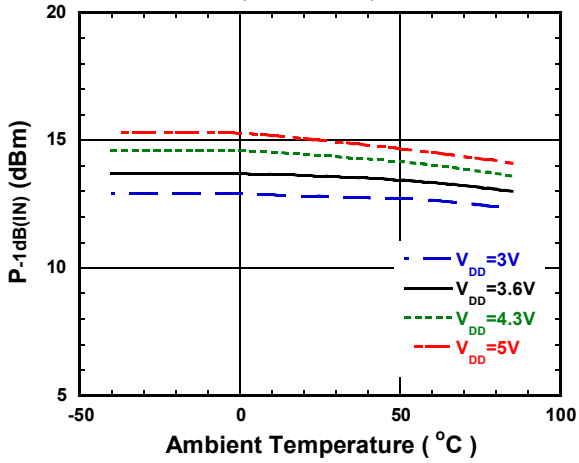
Loss vs. Ambient Temperature

(f=2450MHz)



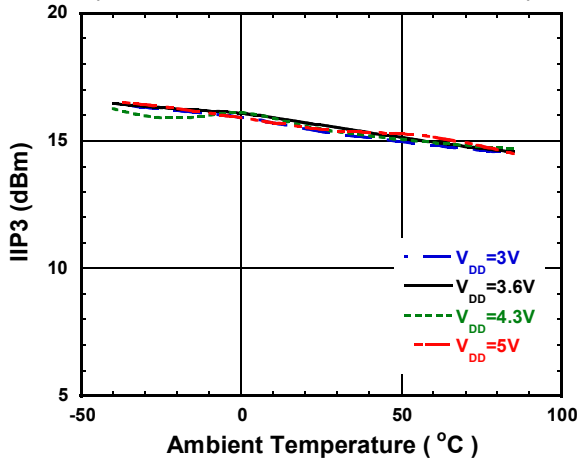
P-1dB(IN) vs. Ambient Temperature

(f=2450MHz)



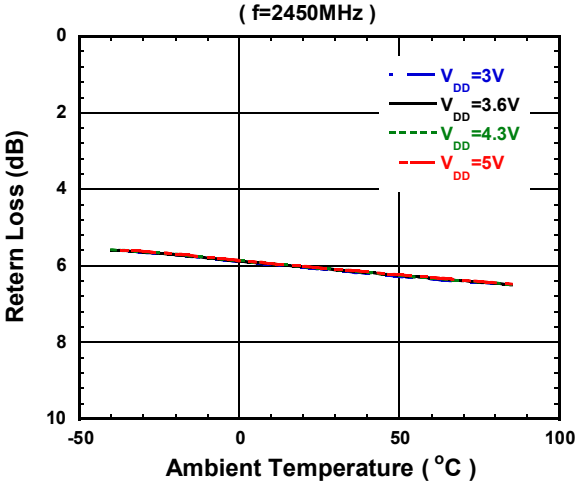
IIP3 vs. Ambient Temperature

(f1=2450MHz, f2=2450.1MHz, Pin=-14dBm)



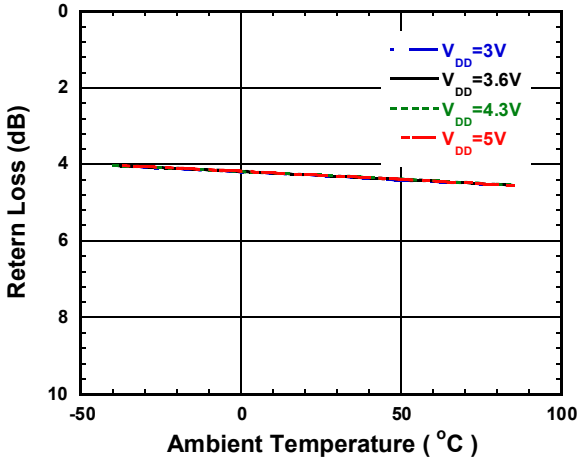
ANT Port Return Loss vs. Abmient Temperature

(f=2450MHz)



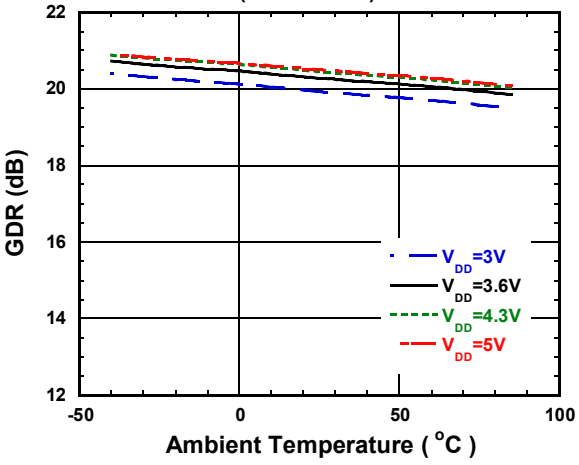
LNAOUT Port Return Loss vs. Ambient Temperature

(f=2450MHz)



GDR vs. Ambient Temperature

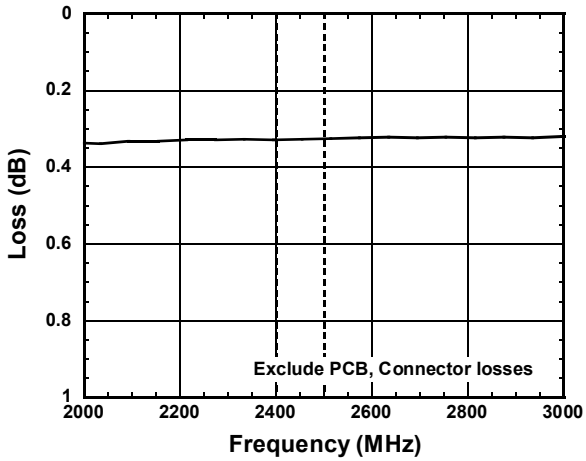
(f=2450MHz)



■ **ELECTRICAL CHARACTERISTICS** (TX mode)

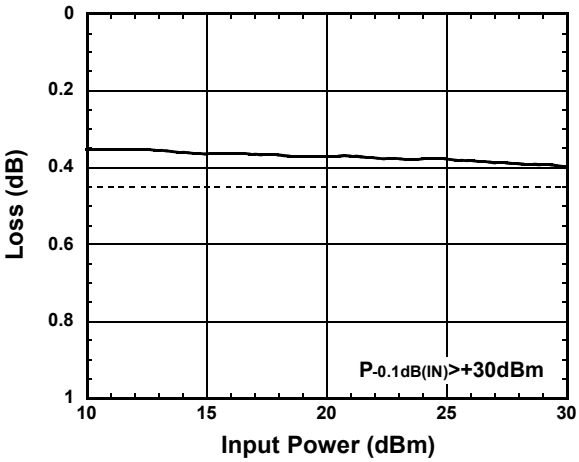
V_{DD}=3.6V, $V_{CTL}2$=3.3V, $V_{CTL}1$=$V_{CTL}3$=$V_{CTL}4$=0V, Ta=25°C, Zs=Zl=50Ω

Loss vs. Frequency



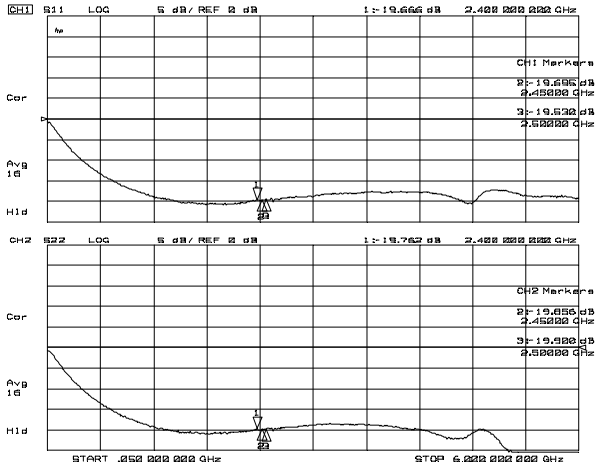
Loss vs. P_{IN}

(f=2450MHz)

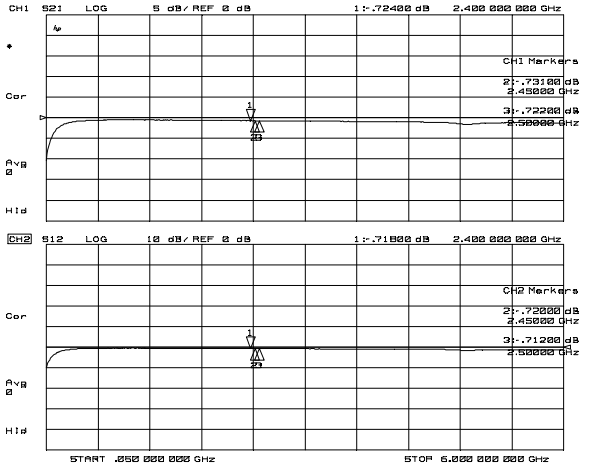


■ ELECTRICAL CHARACTERISTICS (TX mode)

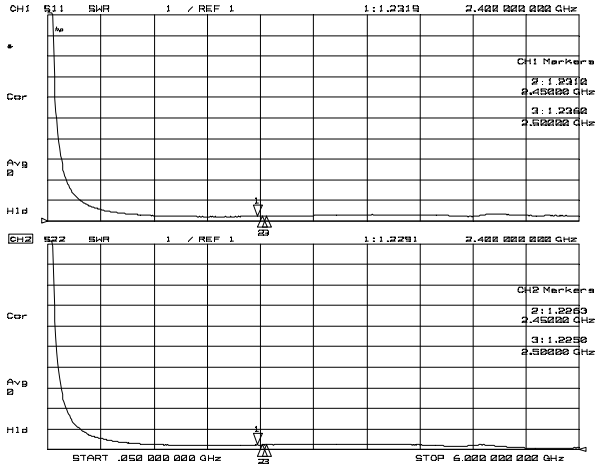
V_{DD}=3.6V, V_{CTL}2=3.3V, V_{CTL}1=V_{CTL}3=V_{CTL}4=0V, Ta=25°C, Zs=Zl=50Ω



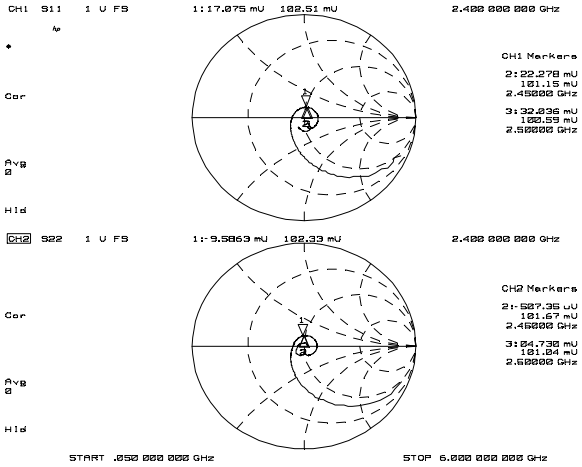
S11, S22 (f=50MHz to 6GHz)



S21, S12 (f=50MHz to 6GHz)



VSWRi, VSWRo (f=50MHz to 6GHz)

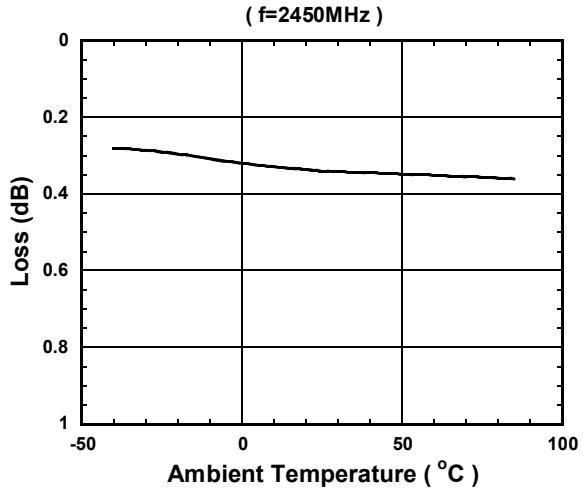


Zin, Zout (f=50MHz to 6GHz)

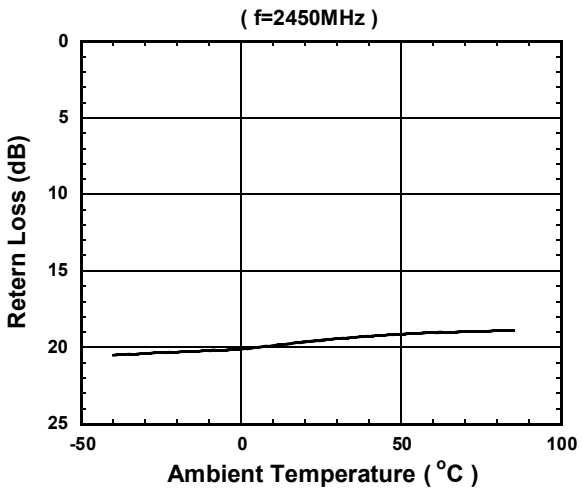
■ **ELECTRICAL CHARACTERISTICS** (TX mode)

V_{DD}=3.6V, V_{CTL}2=3.3V, V_{CTL}1=V_{CTL}3=V_{CTL}4=0V, Zs=Zl=50Ω

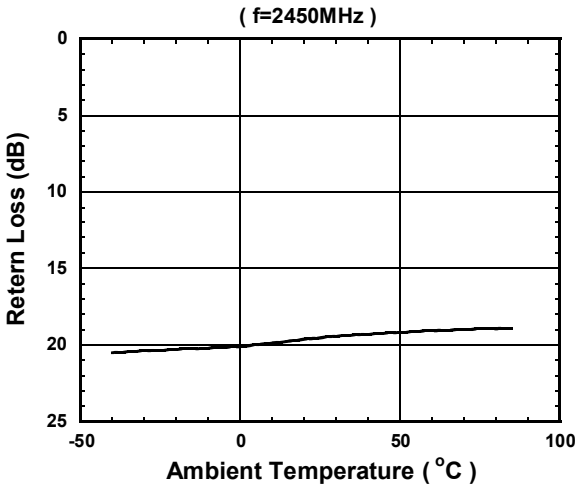
Loss vs. Ambient Temperature



ANT Port Return Loss vs. Ambient Temperature



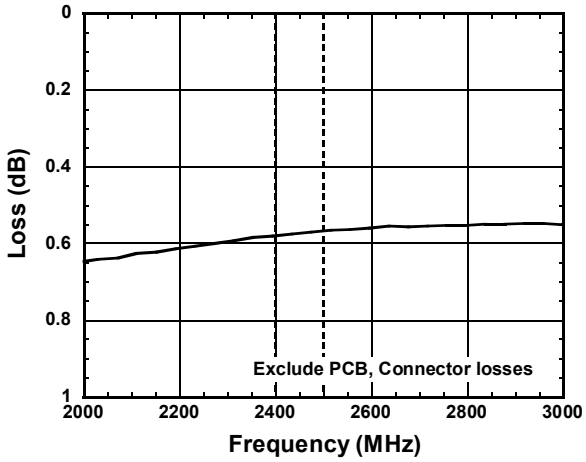
TX Port Return Loss vs. Ambient Temperature



■ **ELECTRICAL CHARACTERISTICS** (BT mode)

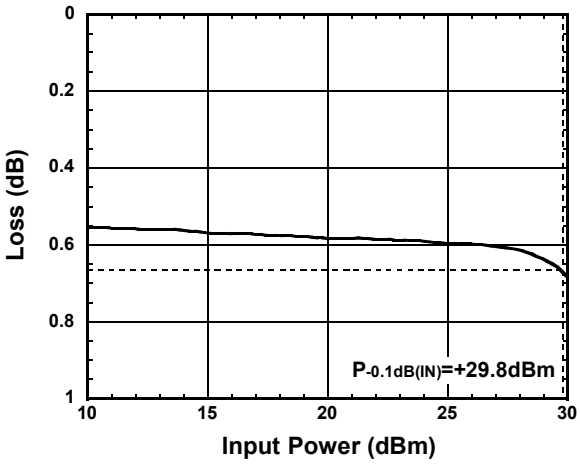
V_{DD}=3.6V, $V_{CTL}3$=3.3V, $V_{CTL}1$=$V_{CTL}2$=$V_{CTL}4$=0V, Ta=25°C, Zs=Zl=50Ω

Loss vs. Frequency



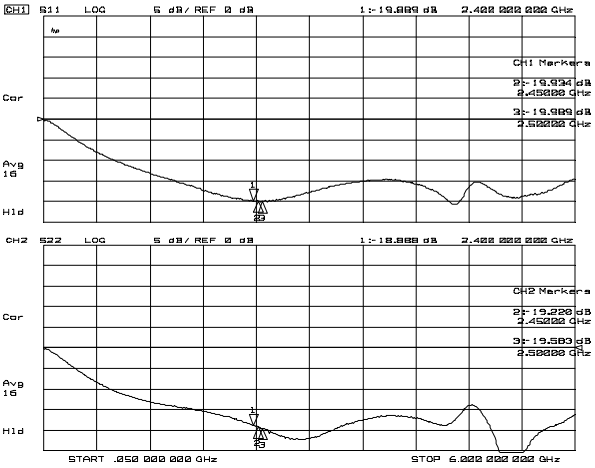
Loss vs. P_{IN}

(f=2450MHz)

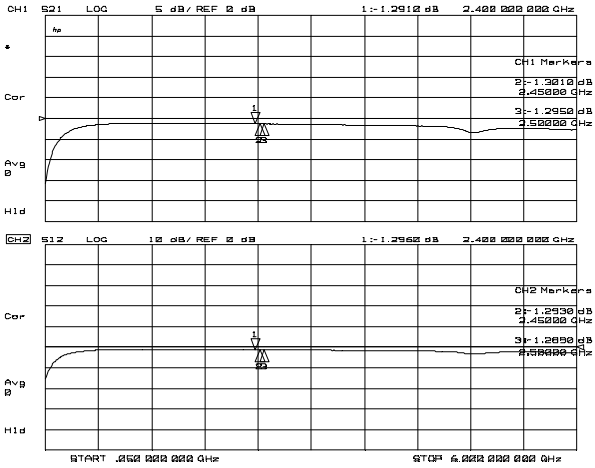


■ ELECTRICAL CHARACTERISTICS (BT mode)

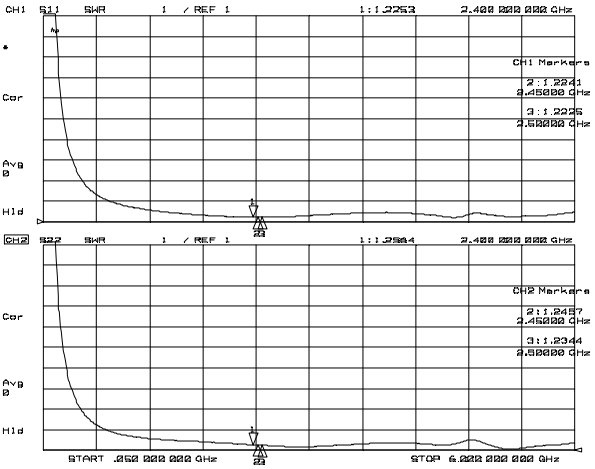
V_{DD}=3.6V, $V_{CTL}3$=3.3V, $V_{CTL}1$=$V_{CTL}2$=$V_{CTL}4$=0V, Ta=25°C, Zs=Zl=50Ω



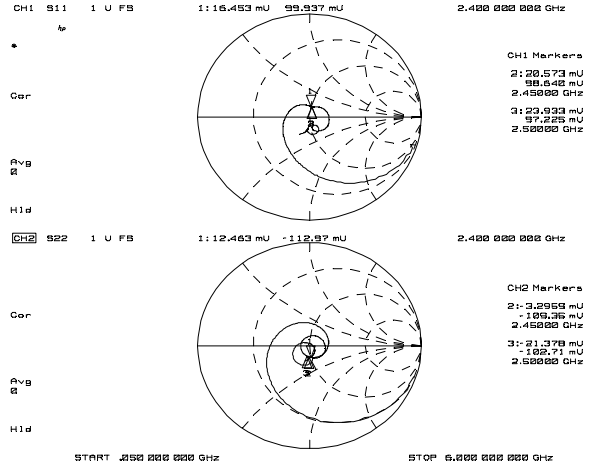
S11, S22 (f=50MHz to 6GHz)



S21, S12 (f=50MHz to 6GHz)



VSWRi, VSWRo (f=50MHz to 6GHz)

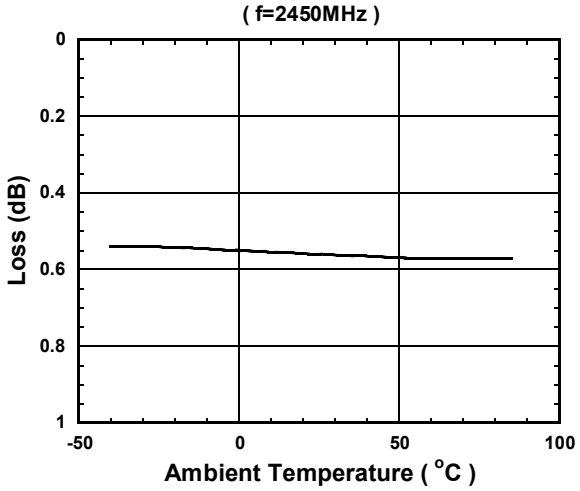


Zin, Zout (f=50MHz to 6GHz)

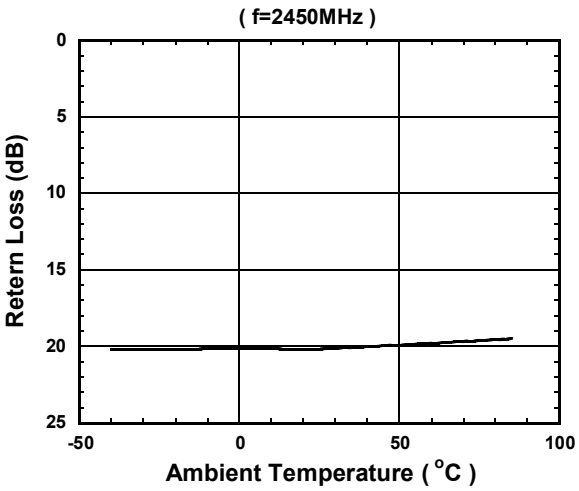
■ **ELECTRICAL CHARACTERISTICS** (BT mode)

V_{DD}=3.6V, V_{CTL}3=3.3V, V_{CTL}1=V_{CTL}2=V_{CTL}4=0V, Zs=Zl=50Ω

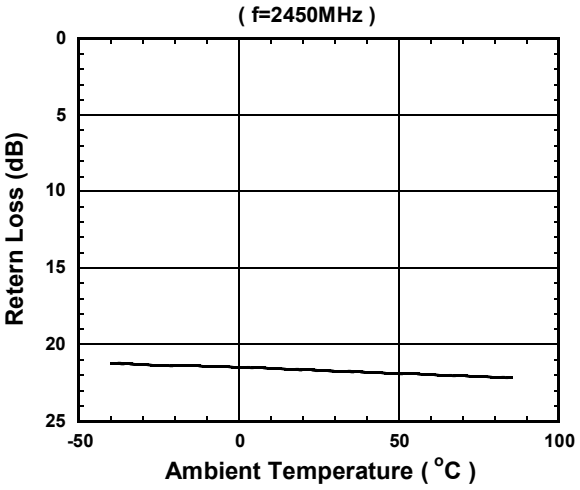
Loss vs. Ambient Temperature



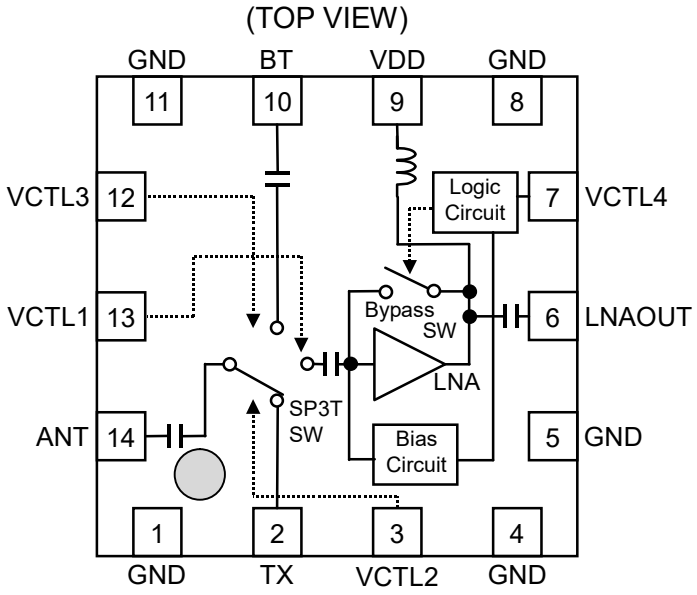
ANT Port Return Loss vs. Ambient Temperature



BT Port Return Loss vs. Ambient Temperature



■ PIN CONFIGURATION



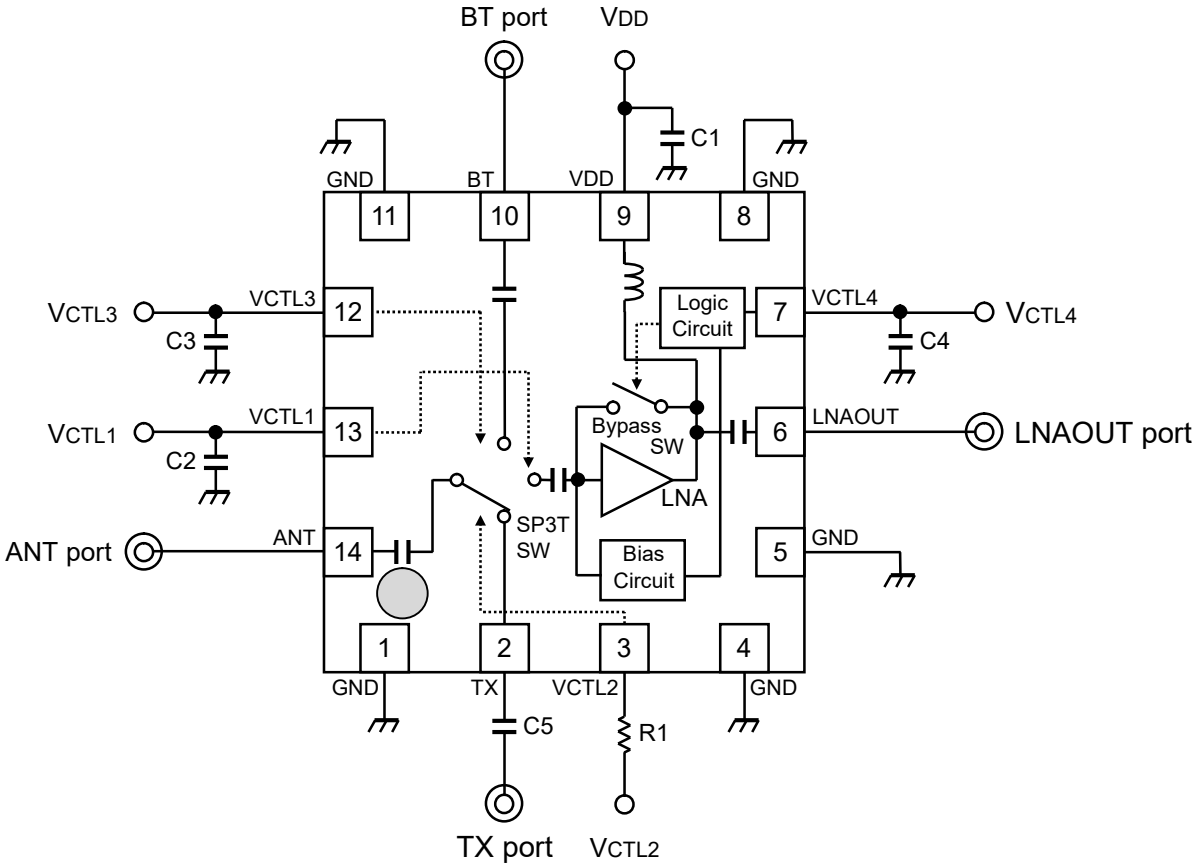
1: GND
2: TX
3: VCTL2
4: GND
5: GND
6: LNAOUT
7: VCTL4
8. GND
9. VDD
10. BT
11. GND
12: VCTL3
13: VCTL1
14: ANT
Exposed pad: GND

■ TRUTH TABLE

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

mode	VCTL1 (SW RX)	VCTL2 (SW TX)	VCTL3 (SW BT)	VCTL4 (LNA)	STATE					
					IDD	LNA	Bypass	RX SW	TX SW	BT SW
RX LNA	H	L	L	H	$I_{DD}1$	ON	OFF	ON	OFF	OFF
RX Bypass	H	L	L	L	$I_{DD}2$	OFF	ON	ON	OFF	OFF
TX	L	H	L	L	$I_{DD}2$	OFF	ON	OFF	ON	OFF
BT	L	L	H	L	$I_{DD}2$	OFF	ON	OFF	OFF	ON
Sleep	L	L	L	L	$I_{DD}3$	OFF	OFF	OFF	OFF	OFF

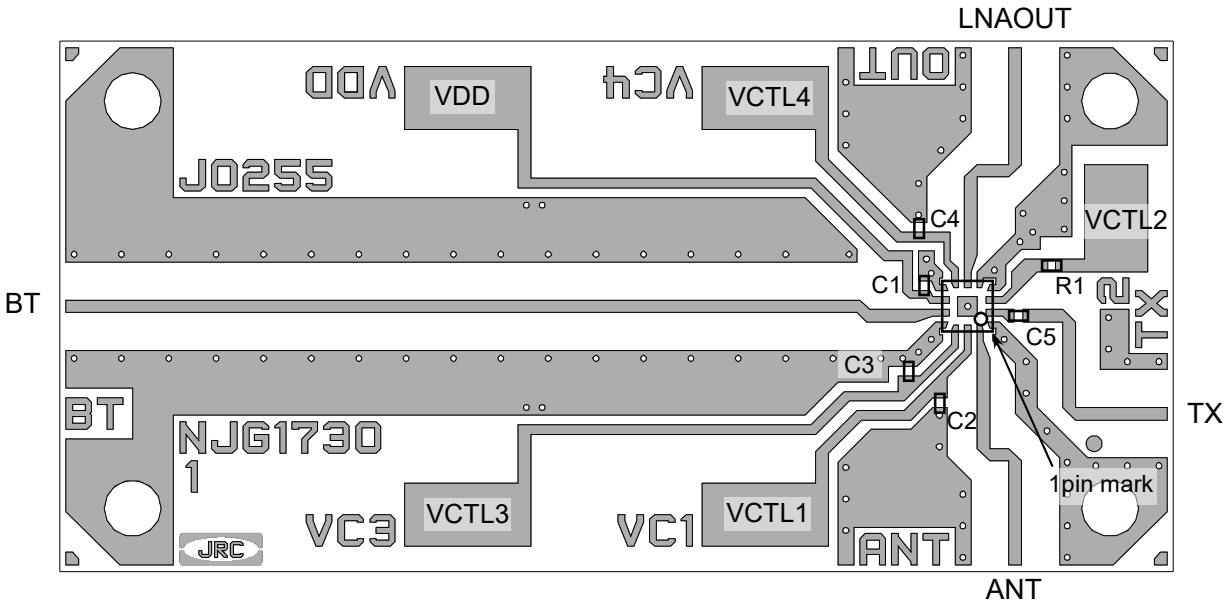
■ APPLICATION CIRCUIT



■ PARTS LIST

ID No.	Value	Notes
C1	1000pF	MURATA (GRM03 series)
C2 to C4	10pF	
C5	56pF	
R1	10kΩ	KOA (RK73B series)

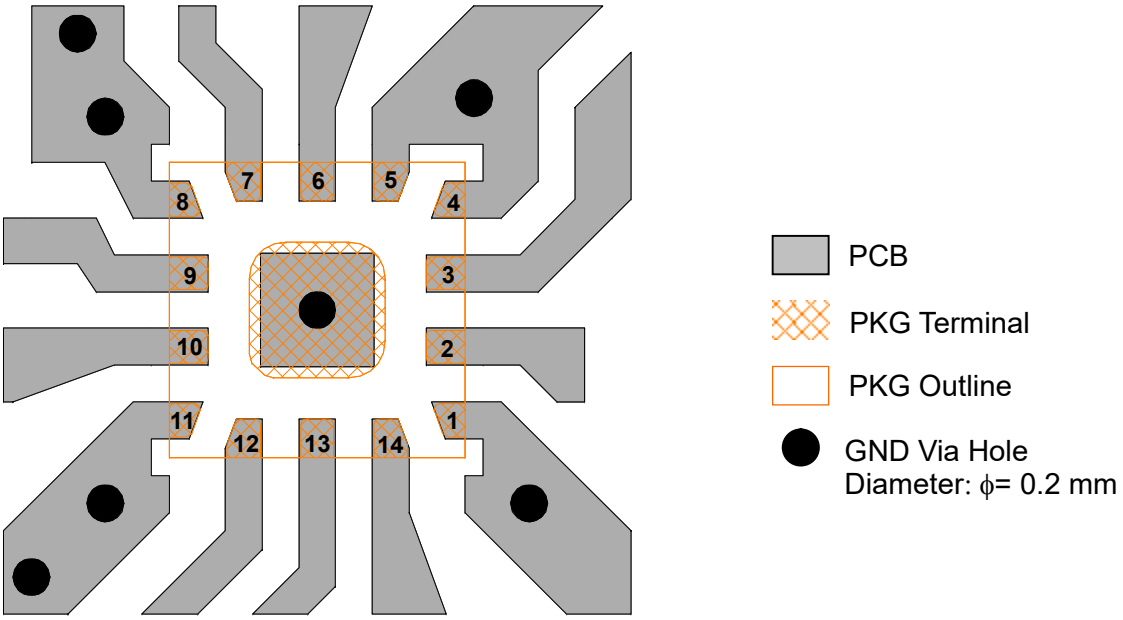
■ APPLIED CIRCUIT BOARD EXAMPLE



PCB Information

Substrate:	FR-4
Thickness:	0.2mm
Microstrip line width:	0.4mm (Z_0=50Ω)
PCB size:	35.2mm x 16.8mm

<PCB LAYOUT GUIDELINE>



PRECAUTIONS

[1] All external parts should be placed as close as possible to the IC.
[2] For avoiding the degradation of RF performance, the bypass capacitor (C1) should be placed as close as possible to VDD terminal.
[3] For good RF performance, the ground terminals must be placed possibly close to ground plane of substrate, and through holes for GND should be placed near by the pin connection.

■ RECOMMENDED FOOTPRINT PATTERN (EQFN14-D7 Package Reference)

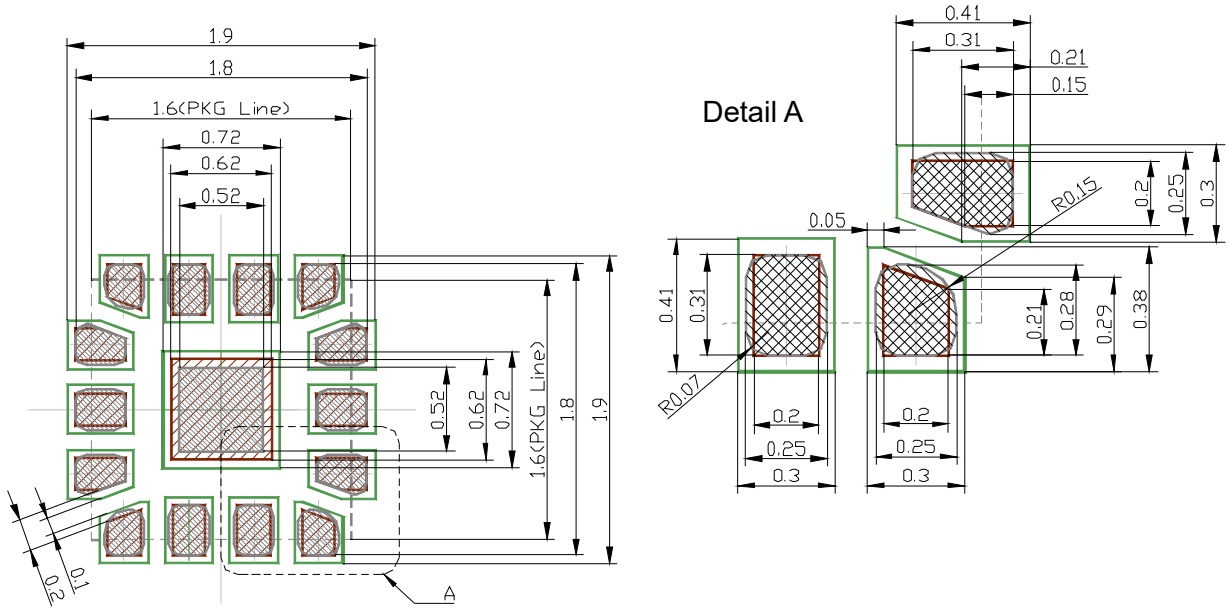
: Land

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

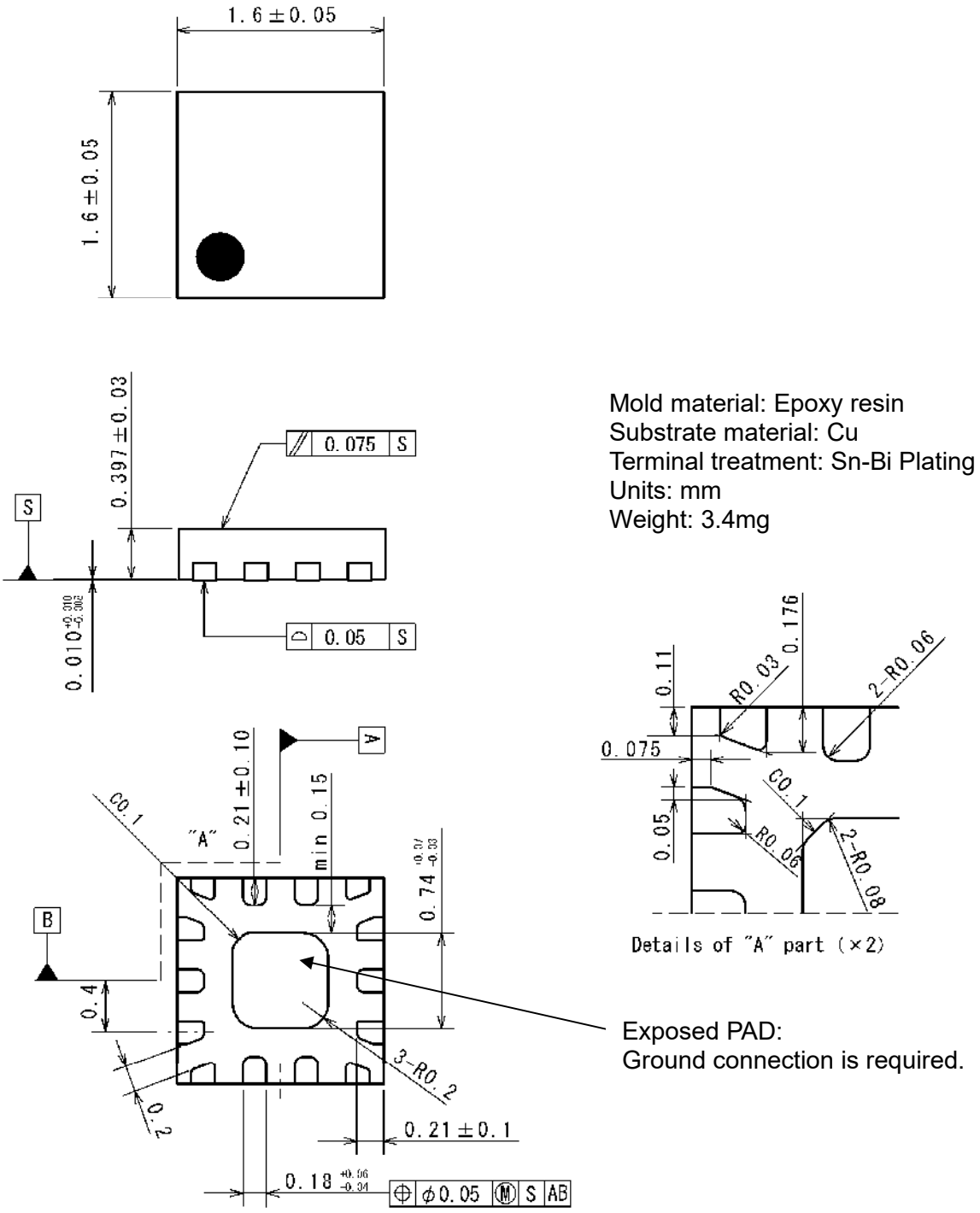
: Resist (Open area)

Package: 1.6mm x 1.6mm
Pin pitch: 0.4mm

Unit: mm



■ PACKAGE OUTLINE (EQFN14-D7)



Mold material: Epoxy resin
Substrate material: Cu
Terminal treatment: Sn-Bi Plating
Units: mm
Weight: 3.4mg

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.

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4. The technical information described in this document shows typical characteristics and example application circuits for the products. The release of such information is not to be construed as a warranty of or a grant of license under our or any third party's intellectual property rights or any other rights.
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    - 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.

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Nisshinbo Micro Devices Inc.

Official website
https://www.nisshinbo-microdevices.co.jp/en/

Purchase information
https://www.nisshinbo-microdevices.co.jp/en/buy/