GaAs SPDT SWITCH IC

■ GENERAL DESCRIPTION

NJG1507R is a GaAs SPDT switch IC operating from 100MHz to 3GHz.

This Switch features low loss, high isolation and low voltage operation from +2.5V. It is suited for the T/R switch of digital cordless phone.

A very small package is adopted.

■ PACKAGE OUTLINE

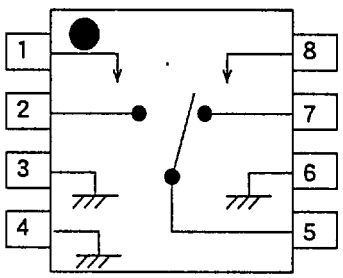
NJG1507R

■ FEATURES

● Only positive and low control voltage	+2.5V ~ +5.5V
● Low insertion loss	0.5dB Typ. @f=2GHz, P_{in}=22dBm.
● Passing power	27dBm Max. @f=2GHz V_{CTR}=3V
● High Isolation	33dB Typ. @f=2GHz, P_{in}=22dBm
● Low control current	5uA Typ. @f=0.1 ~ 2.5GHz, Pin=22dBm
● Small package	VSP8

■ PIN CONFIGURATION

R Type
(Top View)



Pin Connection

1. V_{CTR2}
2. P2
3. GND
4. GND
5. PC
6. GND
7. P1
8. V_{CTR1}

■ TRUTH TABLE

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

V_{CTR1}	H	L	L	H
V_{CTR2}	L	H	L	H
P1-PC	OFF	ON	Loss=15dB P_1 Return Loss=-3dB	Loss=16dB P_1 Return Loss=-2dB
P2-PC	ON	OFF	Loss=15dB P_2 Return Loss=-3dB	Loss=16dB P_2 Return Loss=-2dB

Note) The values of "Loss" and "Return Loss" are typical values.

■ ABSOLUTE MAXIMUM RATINGS

(Ta=25℃)

PARAMETER	SYMBOL	RATINGS	UNIT
Input Power	P_{in}	33	dBm
Control Voltage	V_{CTR}	6	V
Power Dissipation	P_D	320	mW
Operating Temperature	T_{opr}	-30 ～ +85	℃
Storage Temperature	T_{stg}	-40 ～ +150	℃

■ ELECTRICAL CHARACTERISTICS

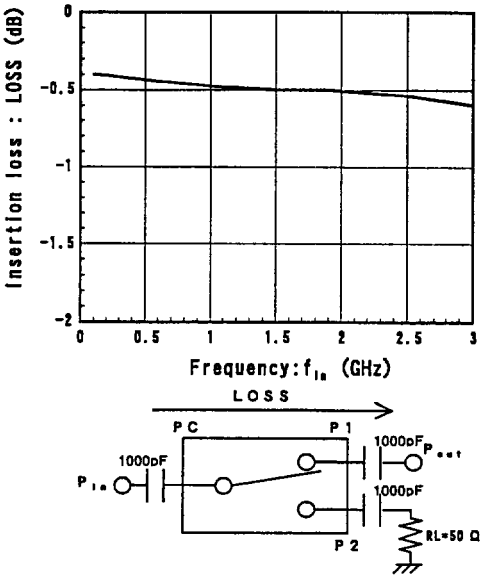
($V_{CTR(L)}$=0V、$V_{CTR(H)}$=2.7V、Z_S=Z_O=50ohm、Ta=25℃)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Control Voltage(L)	$V_{CTR(L)}$	f=0.1～2.5GHz,P_{in}=22dBm	-0.2	0	0.2	V
Control Voltage(H)	$V_{CTR(H)}$	f=0.1～2.5GHz,P_{in}=22dBm	2.5	2.7	5.5	V
Control Current	I_{CTR}	f=0.1～2.5GHz,P_{in}=22dBm	−	5.0	8.0	uA
Insertion Loss 1	LOSS1	f=1GHz,P_{in}=22dBm	−	0.4	0.7	dB
Insertion Loss 2	LOSS2	f=2GHz,P_{in}=22dBm	−	0.5	0.8	dB
Isolation 1 (PC-P1,PC-P2, P1-P2)	ISL1	f=1GHz,P_{in}=22dBm	25	31	−	dB
Isolation 2 (PC-P1,PC-P2, P1-P2)	ISL2	f=2GHz,P_{in}=22dBm	25	33	−	dB
Input Power at 1dB Compression 1	P_{-1dB1}	f=2GHz	26	28	−	dBm
Input Power at 1dB Compression 2	P_{-1dB2}	$V_{CTR(H)}$=3.0V,f=2GHz	27	30	−	dBm
VSWR (PC,P1,P2)	VSWR	f=0.1～2.5GHz,ON State	−	1.2	1.5	
Switching Time	T_{SW}	f=0.1～2.5GHz	−	15	−	ns

■TYPICAL CHARACTERISTICS

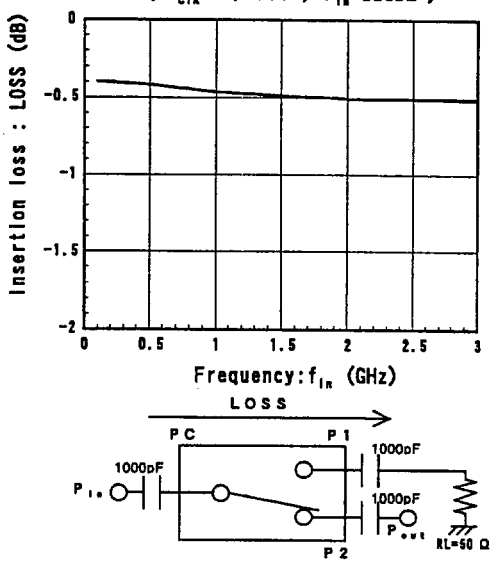
(PC-P1) Insertion loss vs. Frequency

(V_{CTR}=0V/2.7V , P_{in}=22dBm)



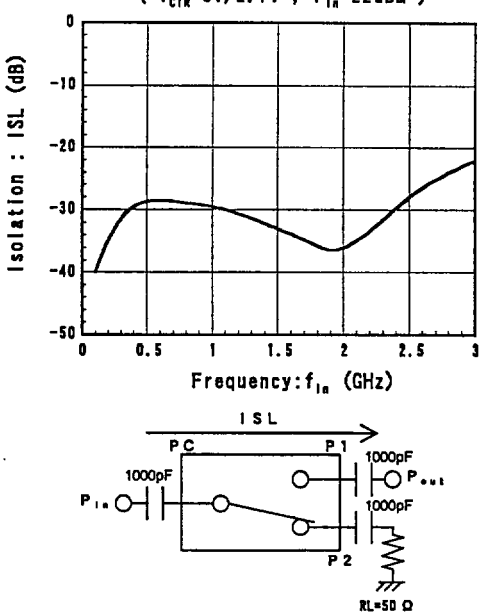
(PC-P2) Insertion loss vs. Frequency

(V_{CTR}=0V/2.7V , P_{in}=22dBm)



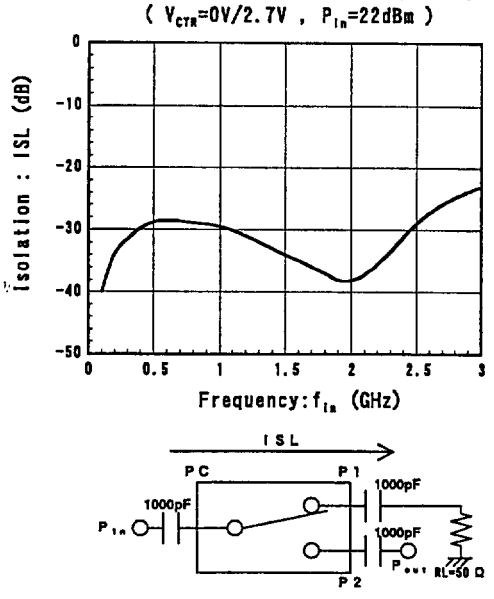
(PC-P1) Isolation vs. Frequency

(V_{CTR}=0V/2.7V , P_{in}=22dBm)



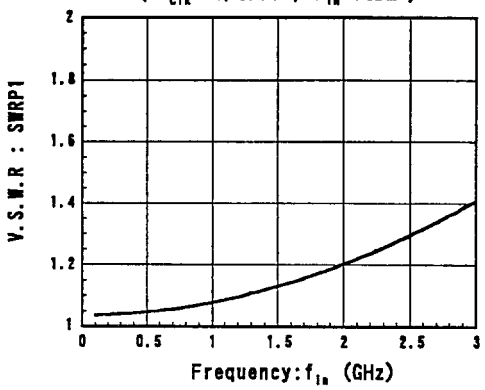
(PC-P2) Isoaltion vs. Frequency

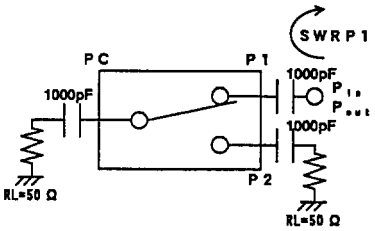
(V_{CTR}=0V/2.7V , P_{in}=22dBm)



P1-PC(ON) V.S.W.R vs. Frequency

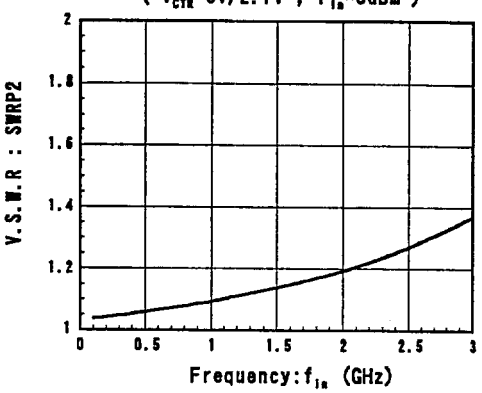
(V_{CTR}=0V/2.7V , P_{in}=0dBm)

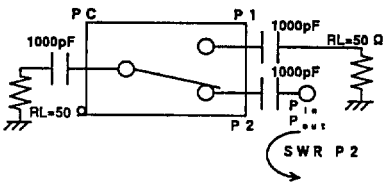




PC-P2(ON) V.S.W.R vs. Frequency

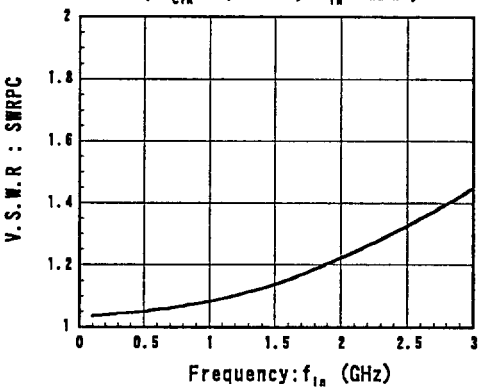
(V_{CTR}=0V/2.7V , P_{in}=0dBm)

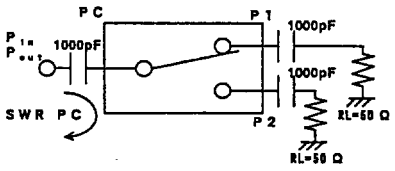




PC-P1(ON) V.S.W.R vs. Frequency

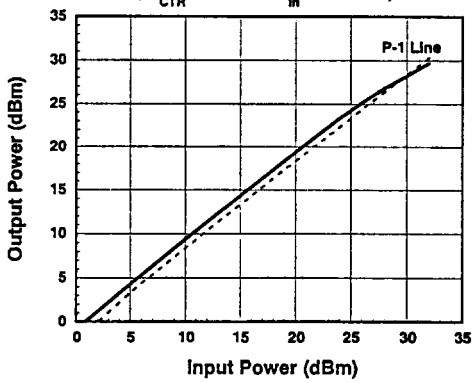
(V_{CTR}=0V/2.7V , P_{in}=0dBm)



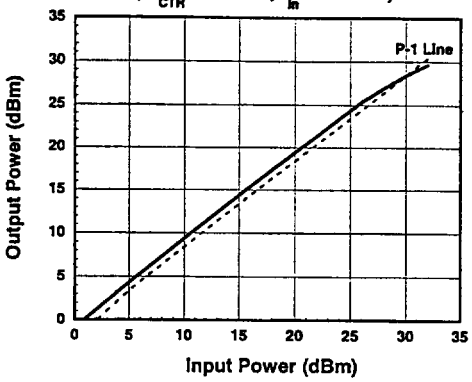


■TYPICAL CHARACTERISTICS

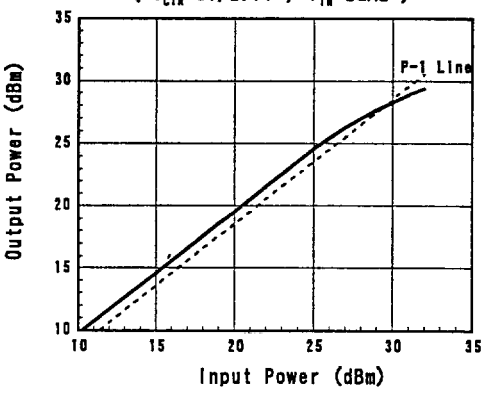
Output Power vs. Input Power
(V_{CTR}=0V/2.7V , f_{in}=300MHz)



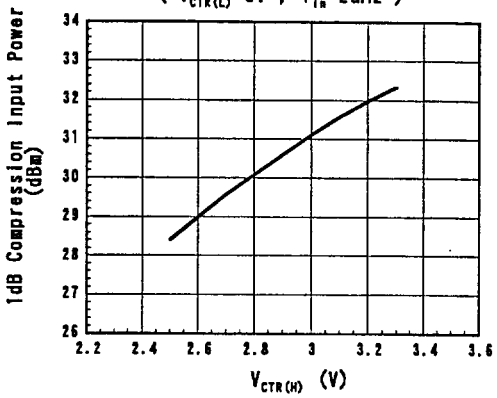
Output Power vs. Input Power
(V_{CTR}=0V/2.7V , f_{in}=900MHz)



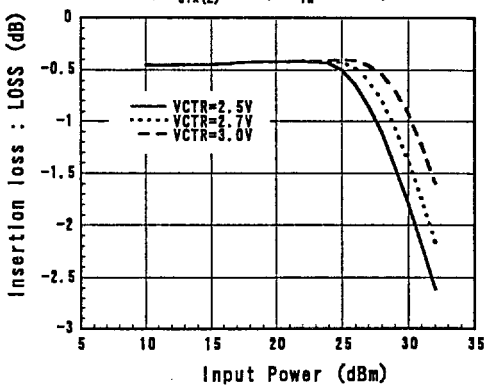
Output Power vs. Input Power
(V_{CTR}=0V/2.7V , f_{in}=2GHz)



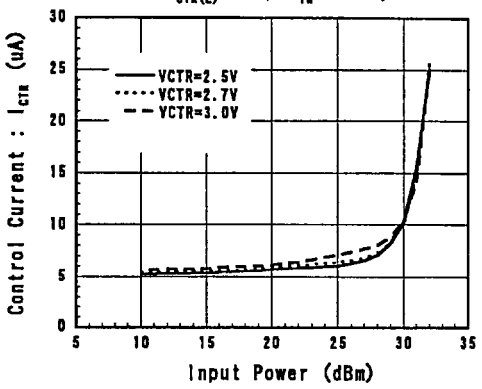
P-1dB vs. Control Voltage
($V_{CTR(L)}$=0V , f_{in}=2GHz)



Insertion Loss vs. Input Power
($V_{CTR(L)}$=0V , f_{in}=2GHz)

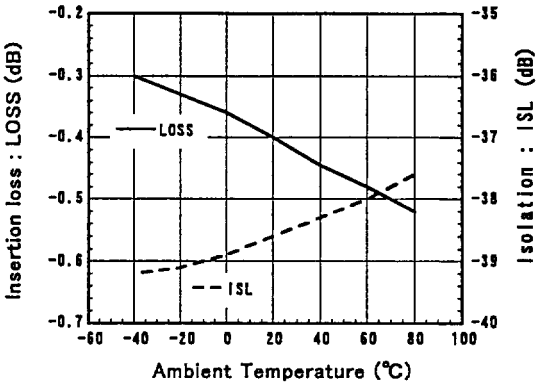


Control Current vs. Input Power
($V_{CTR(L)}$=0V , f_{in}=2GHz)



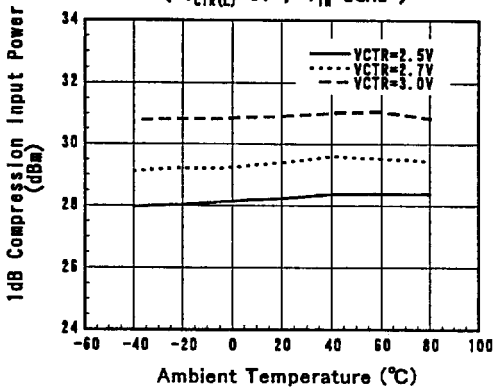
Loss/Isolation vs. Temperature

(V_{CTR}=0V/2.7V , f_{in}=2GHz)



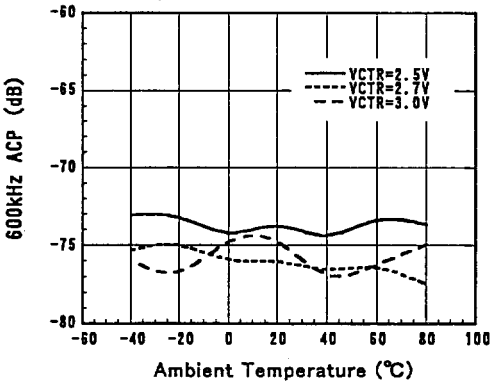
P-1dB vs. Temperature

($V_{CTR(L)}$=0V , f_{in}=2GHz)



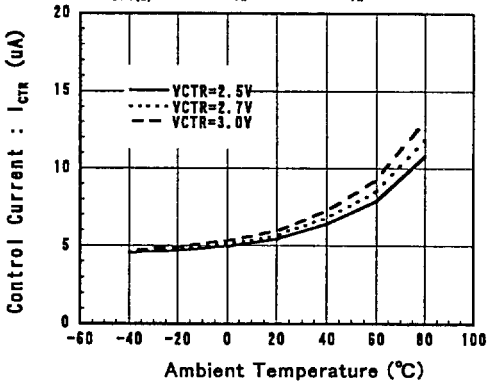
600kHz ACP vs. Temperature

($V_{CTR(L)}$=0V , f_{in}=1.9GHz , P_{in}=22dBm)



Control Current vs. Temperature

($V_{CTR(L)}$=0V , f_{in}=2GHz , P_{in}=22dBm)

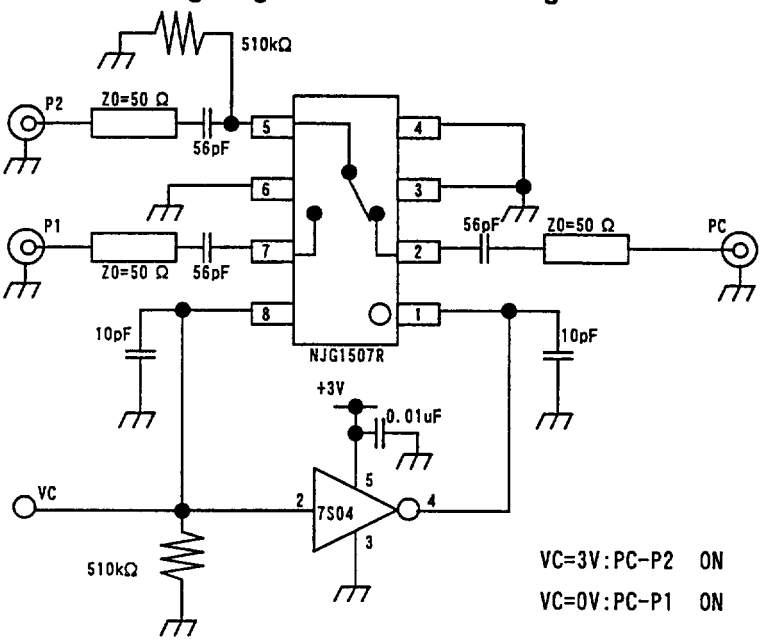


Scattering Parameters : S11(OFF STATE)

(VCTR=0/2.7V , 50 Ω System)

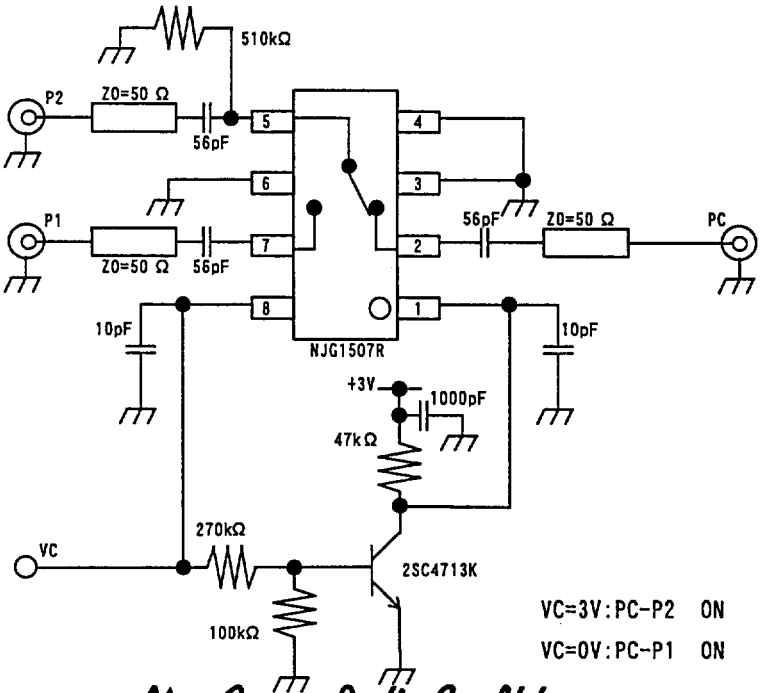
	P1 PORT		P2 PORT	
f(MHz)	Mag.	Ang.(∠°)	Mag.	Ang.(∠°)
50	0.951	-15.8	0.952	-15.9
100	0.941	-30.9	0.938	-31.0
200	0.911	-59.2	0.911	-59.2
300	0.879	-84.9	0.877	-84.6
400	0.849	-107.4	0.850	-106.7
500	0.823	-127.2	0.824	-126.0
600	0.803	-144.6	0.805	-142.8
700	0.787	-160.1	0.791	-157.6
800	0.777	-174.1	0.780	-171.0
900	0.768	173.1	0.770	176.8
1000	0.761	161.2	0.763	165.5
1100	0.750	149.6	0.749	154.2
1200	0.751	139.8	0.749	144.7
1300	0.748	129.7	0.745	135.1
1400	0.748	120.1	0.744	125.9
1500	0.745	110.9	0.740	117.0
1600	0.746	102.1	0.737	108.5
1700	0.743	93.6	0.732	100.3
1800	0.742	85.1	0.732	91.9
1900	0.740	76.9	0.728	83.7
2000	0.739	68.9	0.726	75.8
2100	0.740	61.3	0.725	68.3
2200	0.739	53.3	0.723	60.5
2300	0.735	45.8	0.718	52.7
2400	0.735	38.4	0.717	45.2
2500	0.736	30.8	0.714	37.7
2600	0.732	23.8	0.711	30.5
2700	0.734	17.0	0.708	23.4
2800	0.729	9.5	0.706	15.8
2900	0.727	2.5	0.703	8.6
3000	0.721	-4.6	0.698	1.2

■ **APPLICATION CIRCUIT 1 : Single signal control circuit using C-MOS inverter.**



[1] Please connect the bypass capacitor to C-MOS inverter supply terminal.
[2] In order to the state of input impedance of inverter, please pull-down 510K Ω of resistor for C-MOS inverter input terminal.

■ **APPLICATION CIRCUITS 2 : Single signal control circuit using a transistor.**

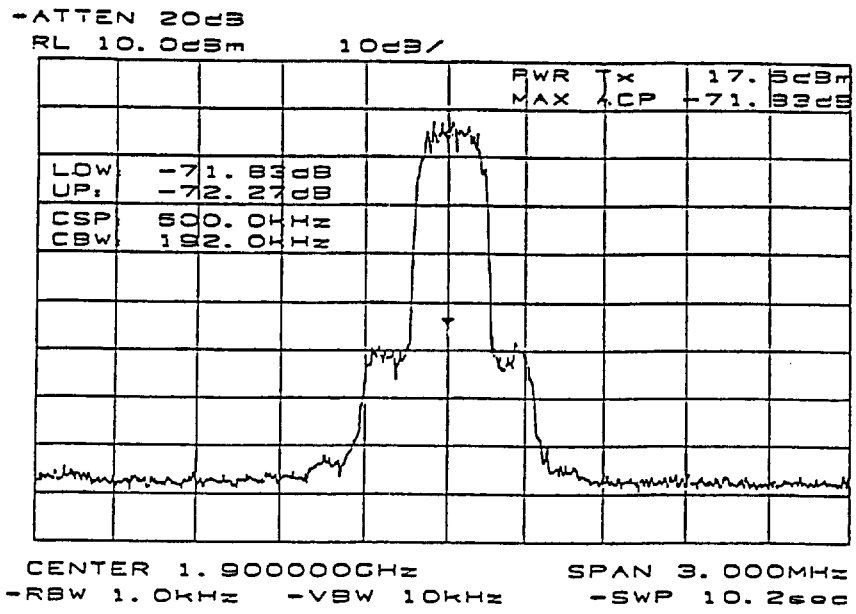


600kHz ACP CHARACTERISTICS (Ta=25°C)

DQPSK Modulation Signal (without D.U.T)

f_{in}=1.9GHz P_{in}=22dBm

MODULATION : 384Kbps RNYQ α=0.5 1/4 π DQPSK

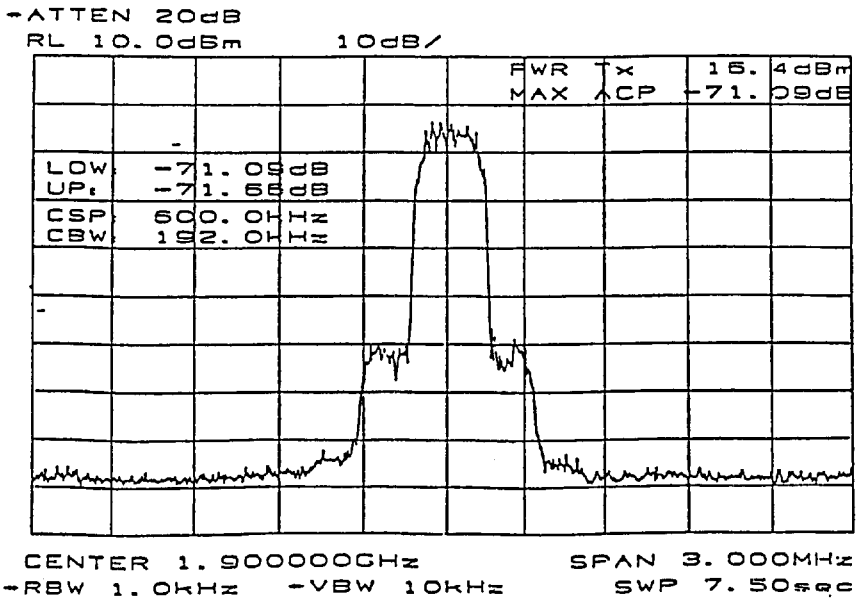


D.U.T Output Signal

Insertion PORT : PC → P1

f_{in}=1.9GHz P_{in}=22dBm V_{CTR}=0/2.7V

MODULATION : 384Kbps RNYQ α=0.5 1/4 π DQPSK



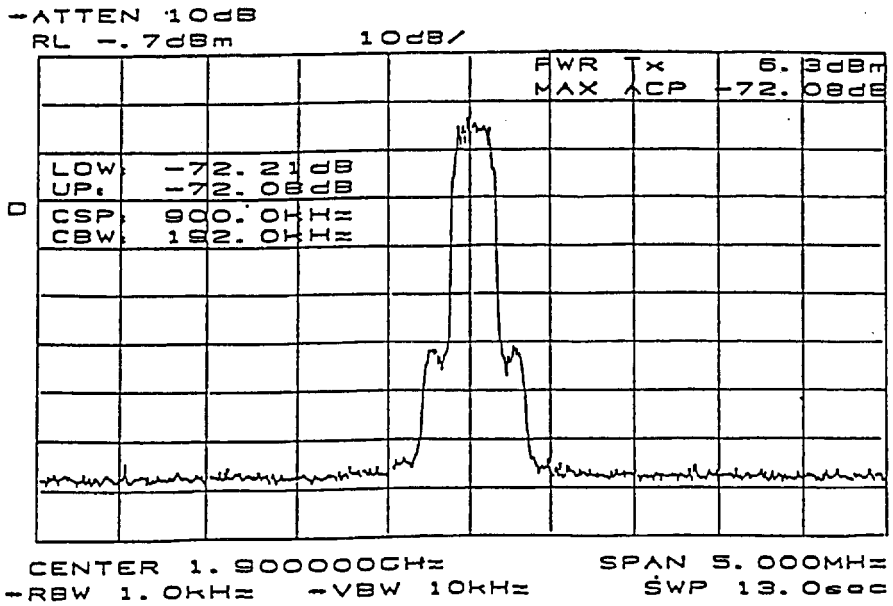
■ TYPICAL CHARACTERISTICS

900kHz ACP (Ta=25°C)

Insertion PORT : PC → P1

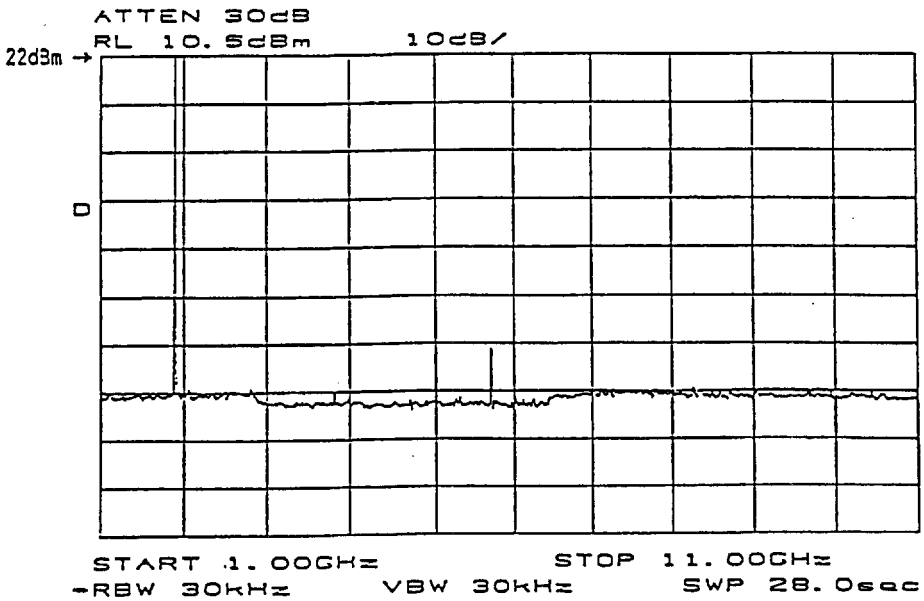
f_{in}=1.9GHz P_{in}=22dBm V_{CTR}=0/2.7V

MODULATION : 384Kbps RNYQ α=0.5 1/4 π DQPSK

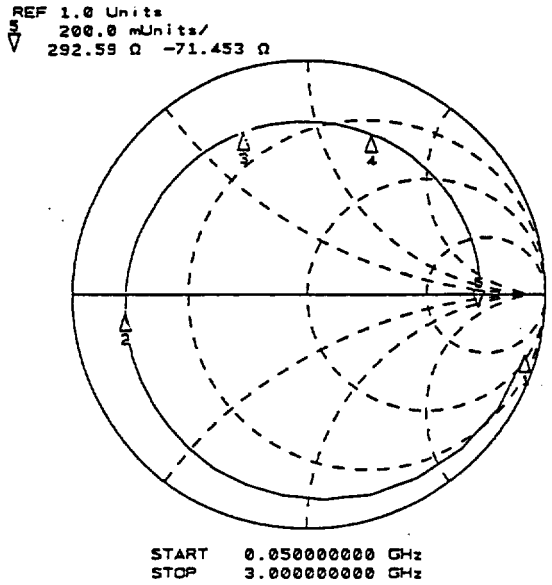


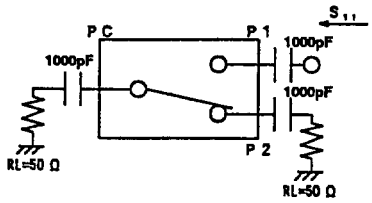
Harmonics (Ta=25°C)

f_{in}=1.9GHz P_{in}=22dBm $V_{CTR(H)}$=2.7V



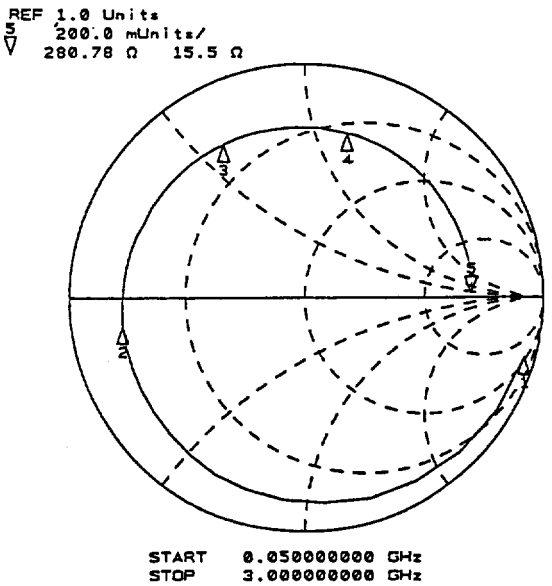
P1 PORT IMPEDANCE (OFF STATE)

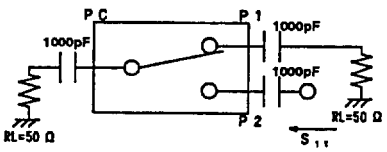




MARKER	f(MHz)	Mag.	Ang.(∠°)
1	50	0.951	-15.8
2	800	0.777	-174.1
3	1500	0.745	110.9
4	2000	0.739	68.9
5	3000	0.721	-4.6

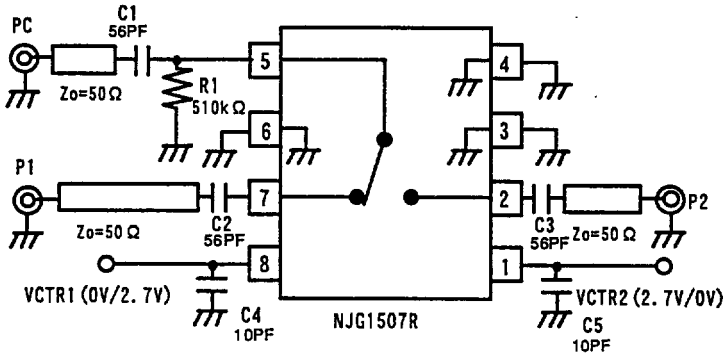
P2 PORT IMPEDANCE (OFF STATE)





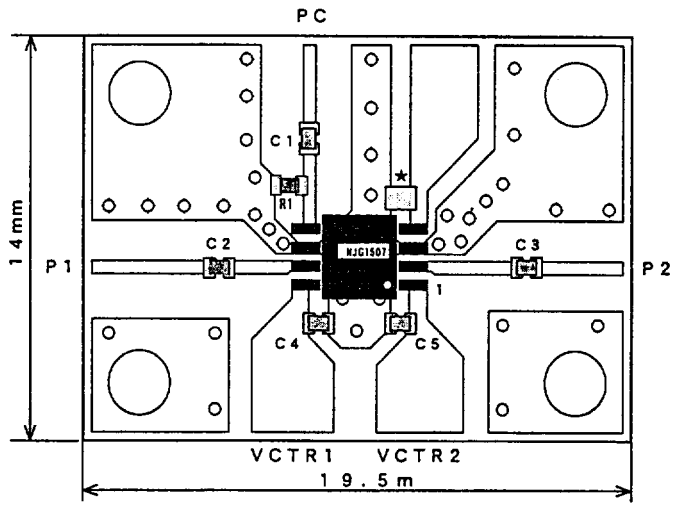
MARKER	f(MHz)	Mag.	Ang.(∠°)
1	50	0.952	-15.9
2	800	0.780	-171.0
3	1500	0.740	117.0
4	2000	0.726	75.8
5	3000	0.698	1.2

■ TEST CIRCUIT



■ RECOMENDED PCB

(TOP VIEW)



PCB:FR-4 t=0.2mm
CAPACITOR:size 1005
STRIP LINE WIDTH=0.5mm
C1 ～ C3 : 56pF
C4,C5 : 10pF
★:Please electrical short between PIN4 and ground near IC

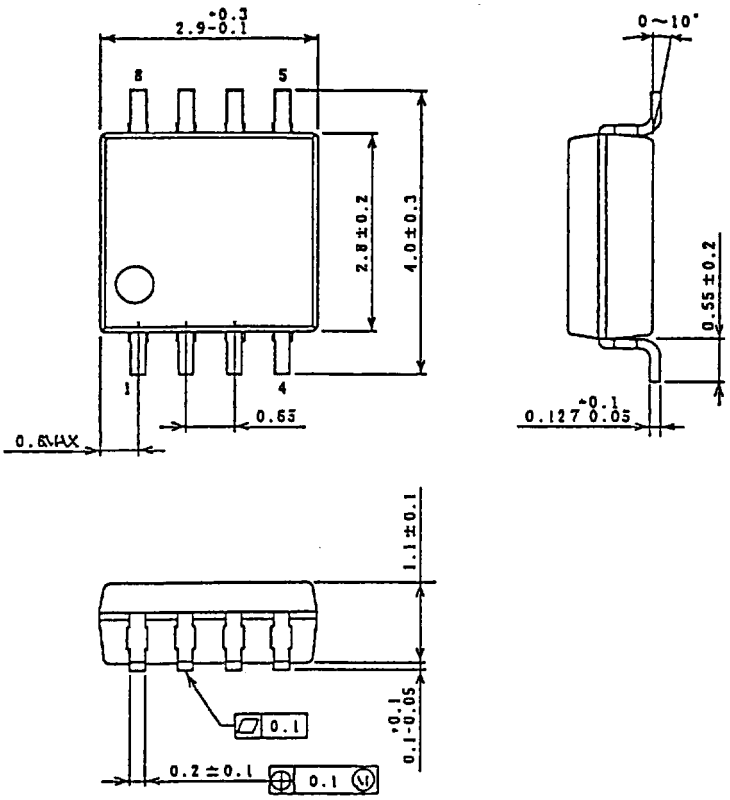
Usage precaution on devices

[1] Outer capacitors should be connected to the input and output RF frequency terminal(P1,P2,PC)to block the DC current. The above figure is a circuit's example to a frequency at 1.9GHz. Please use a capacitor from 10pF to 1000pF to be suited for using band.

[2] Decoupling capacitors should be connected to the control terminals(V_{CTR1},V_{CTR2}) as near as possible. The values of these capacitors should be selected from 5pF to 100pF for using band. But take care of the switching time because the capacitor make the switching time late.

[3] In order to keep good isolation characteristics, the ground terminal (3,4,6 pin)should be connected to ground pattern with relatively wide width as near as possible, and Though-hole in the ground plane should be placed as near as possible too.

■ PACKAGE OUTLINE



UNIT:mm

Caution on using the products

A GaAs is used in this products. A GaAs is a harmful material.

- Don't eat or in the mouth.
- Don't dispose in fire or break up the products.
- Don't be make a gas or a powdered with the chemical reaction.
- In the case of wasting the products, please obey the relation rule in the each country.
- This products may be broken with static electric discharge or serge voltage. Therefore, please note a handling.

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- The product specifications and descriptions listed in this catalog are subject to change at any time, without notice.
- It is to modify the details of this catalog without making any preliminary announcement.
- We don't take upon ourselves the responsibilities that infringe on other people's rights of a patents bringing about the information and drawing in this catalog.
- It is not purpose to be equipped with the system needs a high reliability as air system, submarine cable system, atomic energy control system and medical instrument for keeping life.
  If you think the above system, please ask for the sales office beforehand.