GaAs SPDT SWITCH IC

■ GENARAL DESCRIPTION

NJG1506R is a GaAs SPDT switch IC featuring a low loss, a high isolation and a low control current.

In the wide frequency range from 100MHz to 3GHz, this IC operates at a low voltage from 2.5V.

A very small package is adopted.

It is suited for the switch in receiving circuit of RF frequency of cellular radio system.

■ PACKAGE OUTLINE

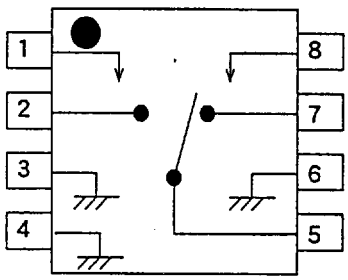
NJG1506R

■ FEATURES

●Single and low control voltage	+2.5～+5.5V	
●Low insertion loss	0.3dB	Typ. @f=1GHz、Pin=0dBm
●High isolation	28dB	Typ. @f=1GHz、Pin=0dBm
●Passing power	19dBm	MAX. @f=2GHz、VCTR=3.0V
●Low control current	1uA	Typ. @f=0.1～2.5GHz,Pin=10dBm
●Small package	VSP8	

■ PIN COMFIGURATION

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 RATING

(T_a=25℃)

PARAMETER	SYNBOL	RATINGS	UNIT
Input power	P_{in}	28	dBm
Control voltage	V_{CTR}	6	V
Power dissipation	P_D	320	mW
Operating Temp.	T_{opr}	-30 ~ +85	℃
Storage Temp.	T_{stg}	-40 ~ +150	℃

■ ELECTRICAL CHARACTERISTICS

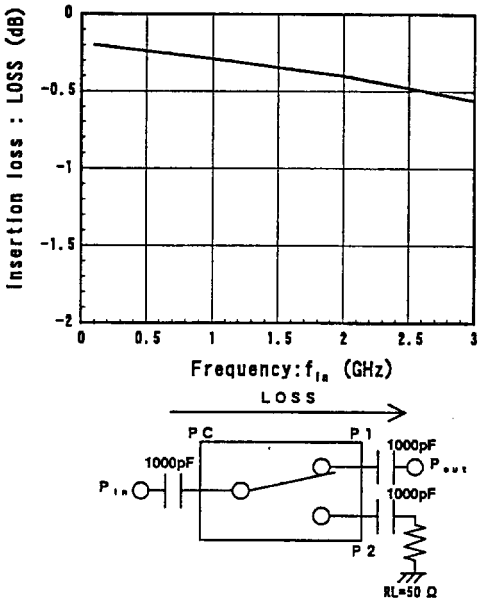
($V_{CTR(L)}$=0V、$V_{CTR(H)}$=2.7V、Z_S=Z_O=50ohm、Ta=25℃)

PARAMETER	SYNBOL	CONDITION	MIN	TYP	MAX	UNIT
Control voltage(L)	$V_{CTR(L)}$	f=0.1~2.5GHz,P_{in}=10dBm	-0.2	0	0.2	V
Control voltage(H)	$V_{CTR(H)}$	f=0.1~2.5GHz,P_{in}=10dBm	2.5	2.7	5.5	V
Control current	I_{CTR}	f=0.1~2.5GHz,P_{in}=10dBm	–	1.0	2.0	uA
Insertion loss1	LOSS1	f=1GHz,P_{in}=0dBm	–	0.3	0.6	dB
Insertion loss2	LOSS2	f=2GHz,P_{in}=0dBm	–	0.5	0.8	dB
Isolation1 (PC-P1,PC-P2, P1-P2)	ISL1	f=1GHz,P_{in}=0dBm	25	28	–	dB
Isolation2 (PC-P1,PC-P2, P1-P2)	ISL2	f=2GHz,P_{in}=0dBm	23	27	–	dB
Input power at 1dB compression	P_{-1dB}	f=2GHz	19	22	–	dBm
VSWR (PC,P1,P2)	VSWR	f=0.1~2.5GHz,ON STATE	–	1.2	1.5	
Switching Speed	T_{SW}	f=0.1~2.5GHz	–	15	–	ns

■ CHARACTERISTICS

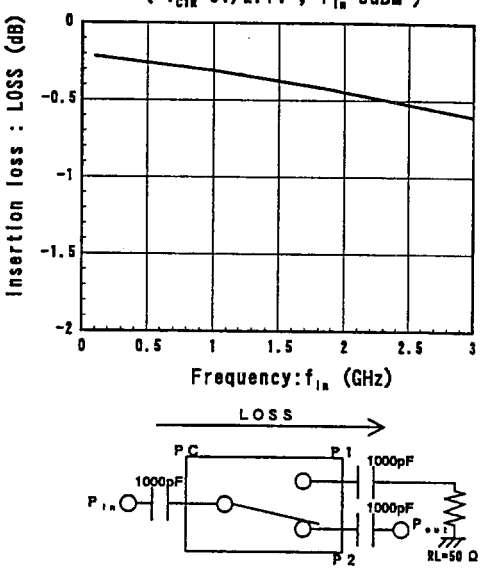
(PC-P1) Insertion loss vs. Frequency

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



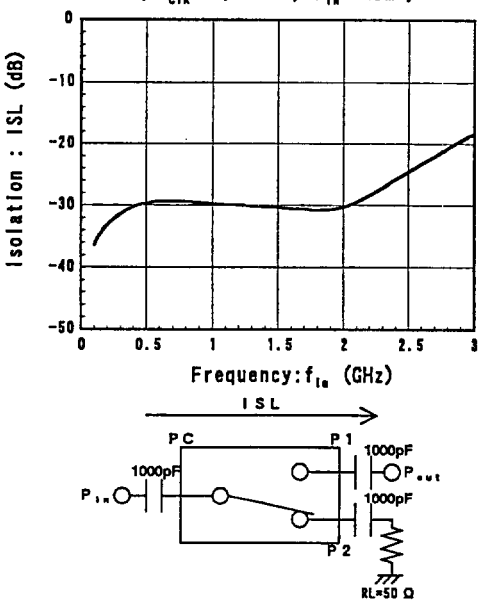
(PC-P2) Insertion loss vs. Frequency

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



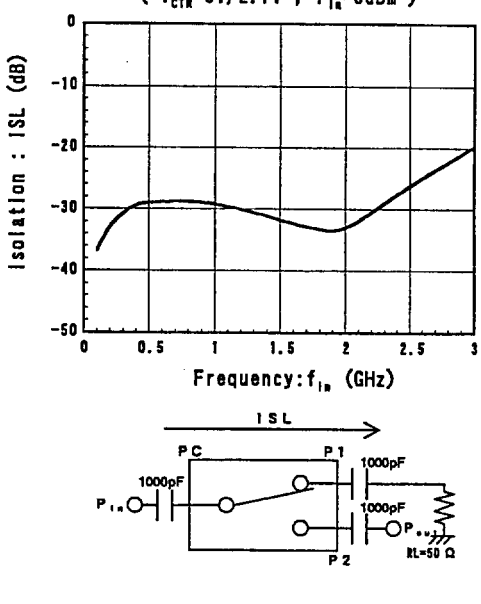
(PC-P1) Isolation vs. Frequency

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



(PC-P2) Isolation vs. Frequency

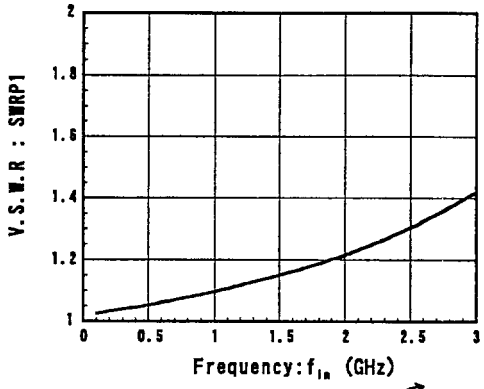
(V_{CTR}=0V/2.7V , P_{in}=0dBm)

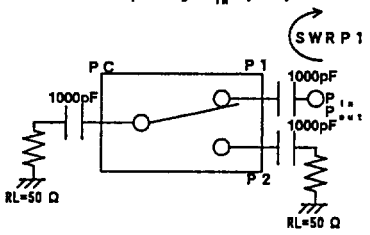


■ CHARACTERRISTICS

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

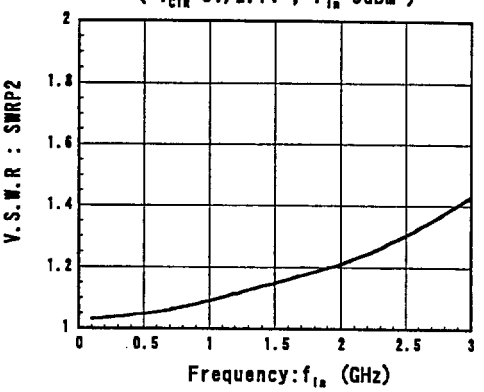
(V_{CTR}=0V/2.7V , P_{in}=0dBm)

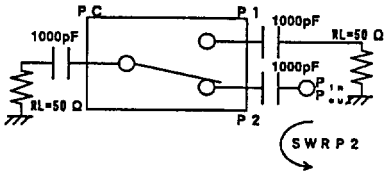




P2-PC(ON) V.S.W.R vs. Frequency

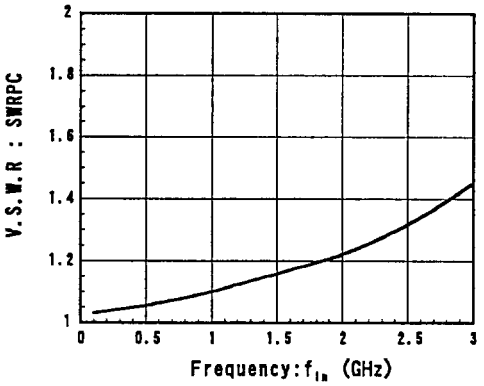
(V_{CTR}=0V/2.7V , P_{in}=0dBm)

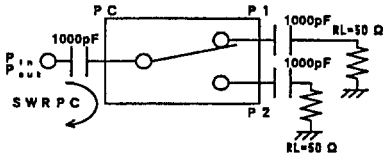




PC-P1(ON)V.S.W.R vs. Frequency

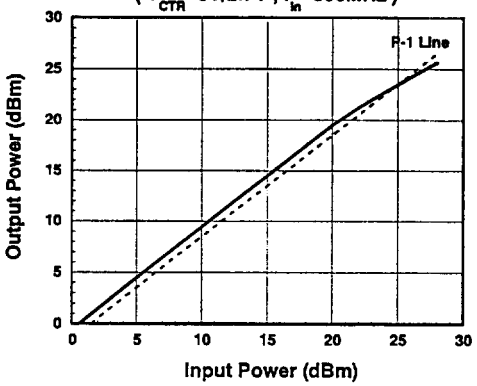
(V_{CTR}=0V/2.7V , P_{in}=0dBm)



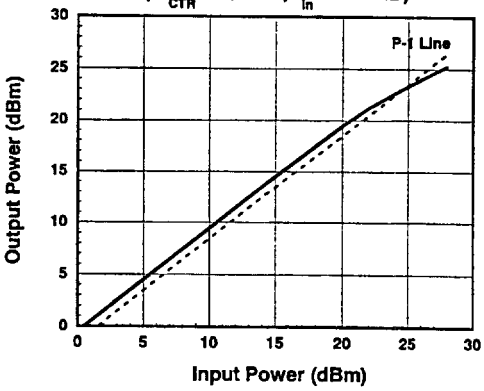


■ CHARACTERISTICS

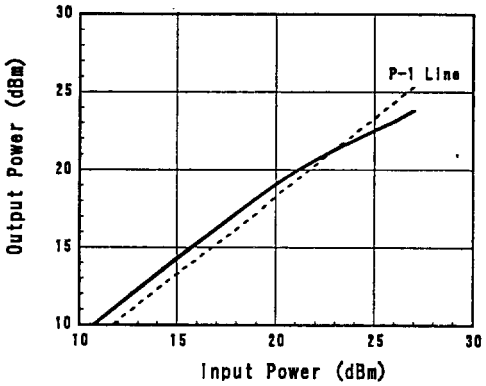
Output Power vs. Input Power
(V_{CTR}=0V/2.7V, f_{in}=300MHz)



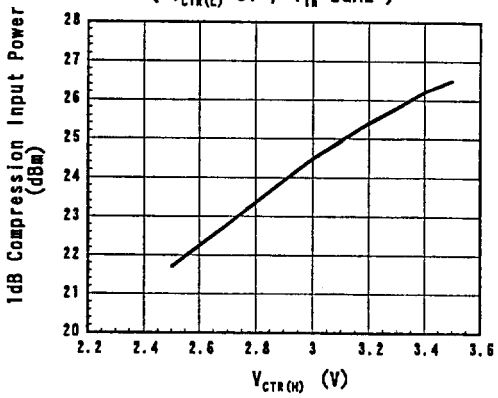
Output Power vs. Input Power
(V_{CTR}=0V/2.7V, f_{in}=900MHz)



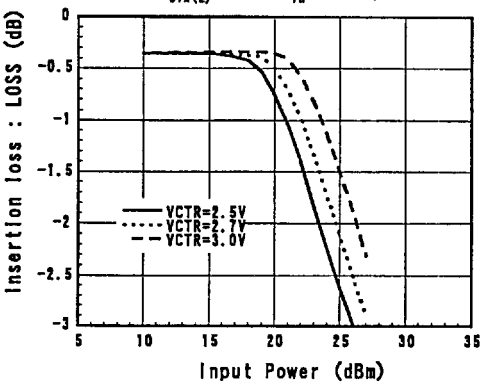
Output Power vs. Input Power
(V_{CTR}=0V/2.7V , f_{in}=2GHz)



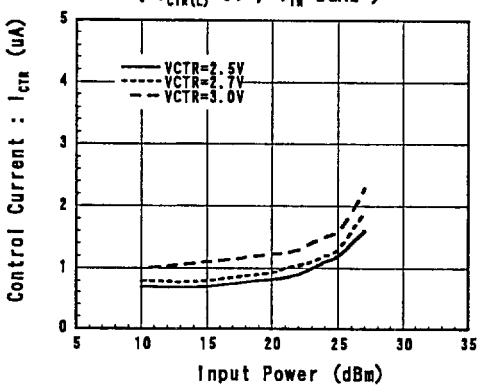
P-1dB vs. Control Voltage
($V_{CTR(L)}$=0V , f_{in}=2GHz)



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



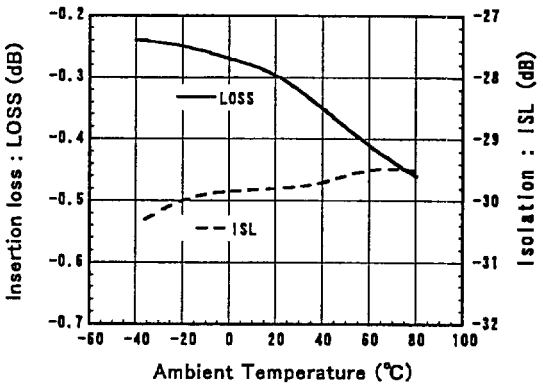
Control Current vs. Input Power
($V_{CTR(L)}$=0V , f_{in}=2GHz)



■ CHARACTERISTICS

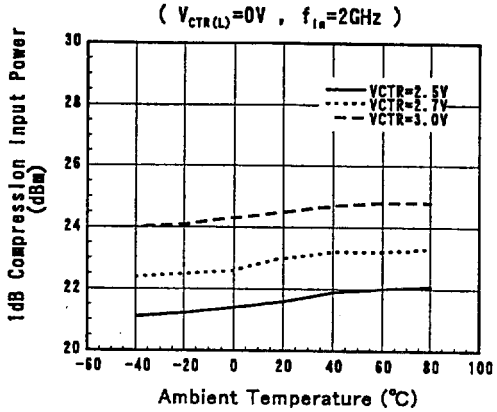
Loss/Isolation vs. Temperature

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



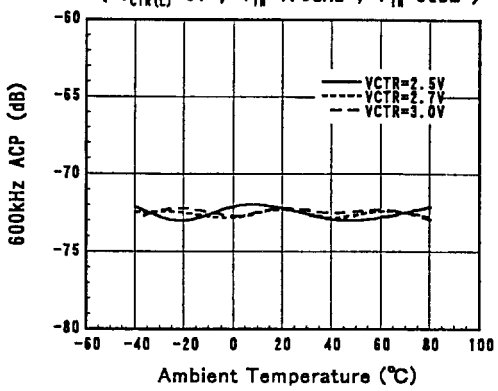
P-1dB vs. Temperature

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



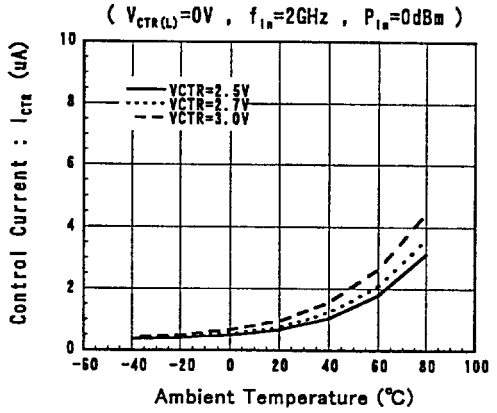
600kHz ACP vs. Temperature

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



Control Current vs. Temperature

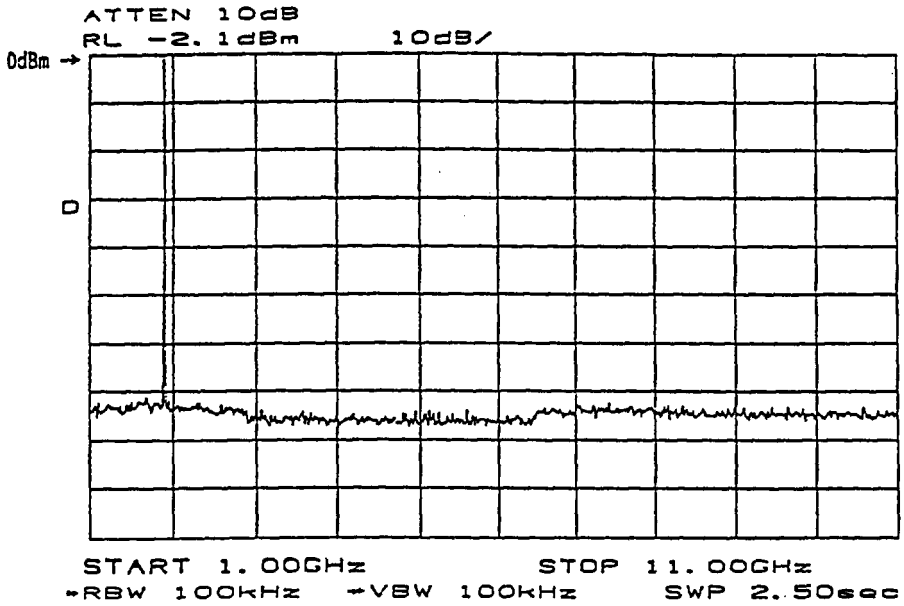
($V_{CTR(L)}$=0V , f_{in}=2GHz , P_{in}=0dBm)



■ CHARACTERISTICS

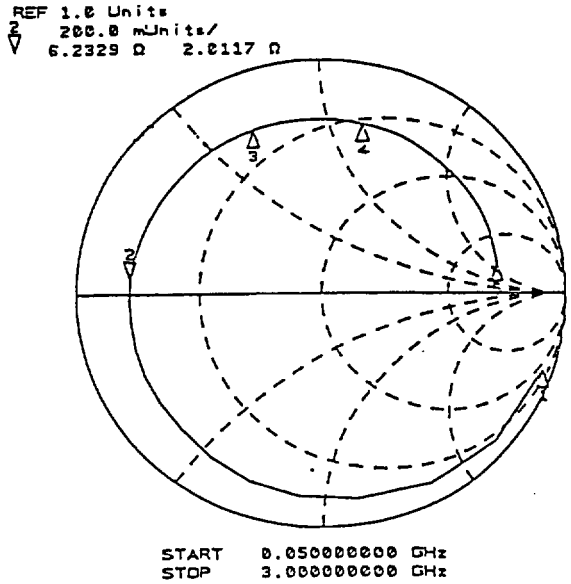
Harmonics (Ta=25°C)

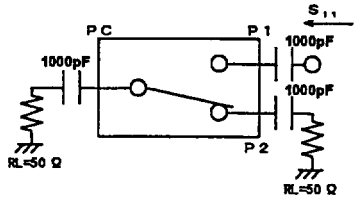
f_{in}=1.9GHz P_{in}=0dBm $V_{CTR(H)}$=2.7V



■ TYPICAL CHARACTERISTICS

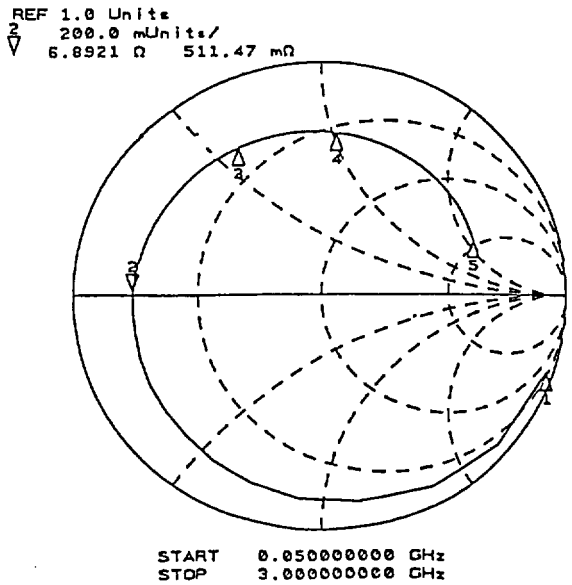
P1 PORT IMPEDANCE (OFF STATE)

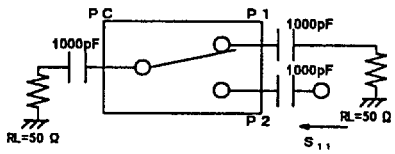




MARKER	f (MHz)	Mag.	Ang. (∠°)
1	50	0.957	-20.2
2	800	0.782	171.2
3	1500	0.759	102.0
4	2000	0.747	61.8
5	3000	0.710	-11.3

P2 PORT IMPEDANCE (OFF STATE)





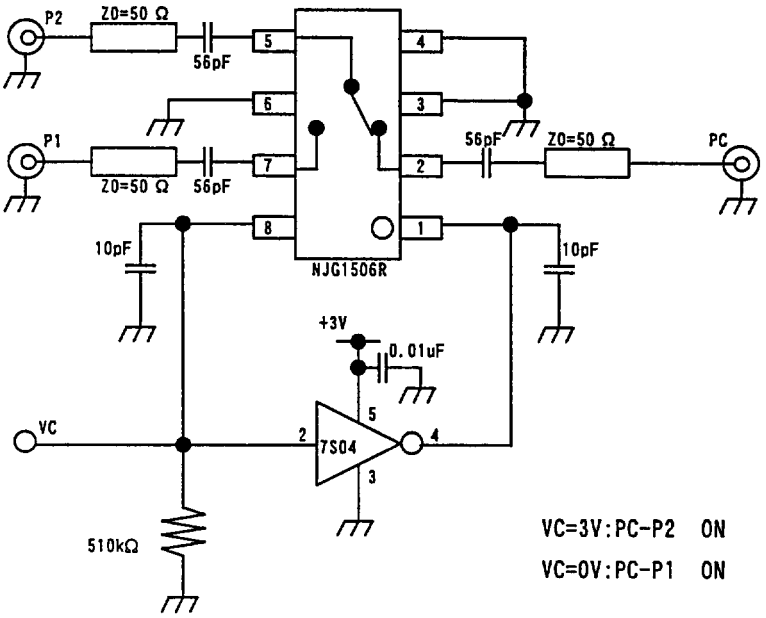
MARKER	f (MHz)	Mag.	Ang. (∠°)
1	50	0.968	-20.2
2	800	0.782	174.5
3	1500	0.749	108.2
4	2000	0.734	69.5
5	3000	0.690	-1.2

Scattering Parameters : S11(OFF STATE)

(VCTR=0/2.7V , 50Ω System)

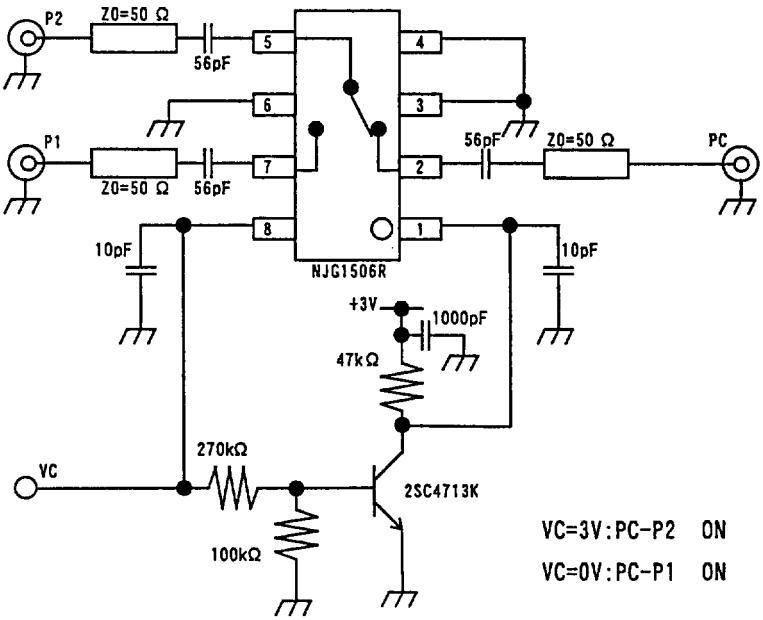
	P1 PORT		P2 PORT	
f(MHz)	Mag.	Ang.(∠°)	Mag.	Ang.(∠°)
50	0.957	-20.2	0.968	-20.2
100	0.942	-39.5	0.954	-39.3
200	0.902	-74.0	0.911	-73.7
300	0.866	-102.8	0.871	-102.0
400	0.836	-126.1	0.840	-124.8
500	0.815	-145.4	0.818	-143.7
600	0.800	-161.8	0.801	-159.5
700	0.791	-176.1	0.790	-173.3
800	0.782	171.2	0.782	174.5
900	0.778	159.6	0.775	163.2
1000	0.772	148.6	0.769	152.8
1100	0.758	138.0	0.757	142.6
1200	0.763	128.8	0.758	133.9
1300	0.762	119.6	0.756	125.0
1400	0.761	110.7	0.752	116.5
1500	0.759	102.0	0.749	108.2
1600	0.756	93.8	0.747	100.3
1700	0.753	85.7	0.744	92.5
1800	0.753	77.6	0.741	84.7
1900	0.750	69.6	0.738	77.0
2000	0.747	61.8	0.734	69.5
2100	0.744	54.4	0.730	62.5
2200	0.744	46.6	0.730	55.0
2300	0.740	39.1	0.723	47.6
2400	0.739	31.8	0.720	40.5
2500	0.733	24.4	0.719	33.4
2600	0.729	17.3	0.711	26.3
2700	0.727	10.3	0.707	19.8
2800	0.722	2.9	0.701	12.5
2900	0.715	-4.2	0.695	5.6
3000	0.710	-11.3	0.690	-1.2

■ **APPLICATION CIRCUIT1** : Single signal control circuit using C-MOS inverter

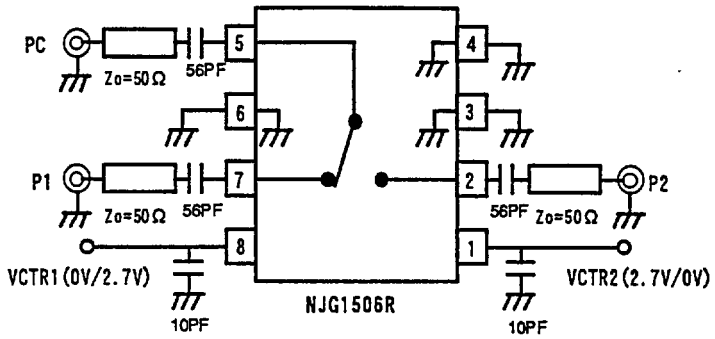


[1] Please connect the bypass capacitor to C-MOS inverter supply terminal.
[2] In order to the state of input impeadence of inverter, please pull-down with 510k Ω of resister for C-MOS inverter input terminal.

■**APPLICATION CIRCUIT2** : Single signal control circuit using a transistor.

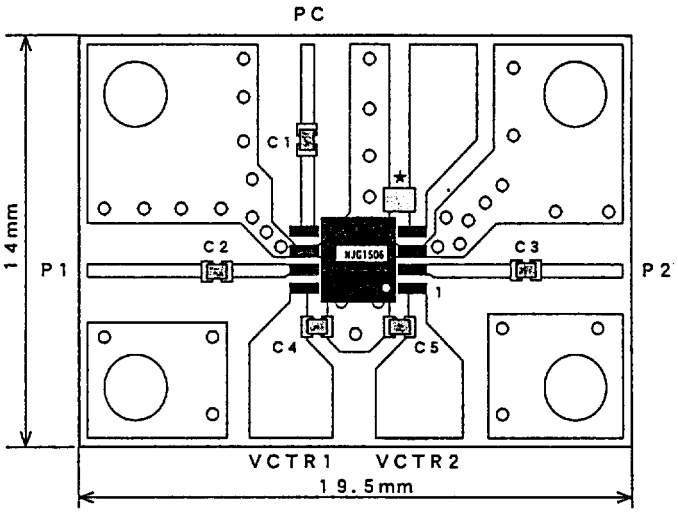


■ TEST CIRCUIT



■ RECOMMENDED PCB

(TOP VIEW)



PCB:FR-4 t=0.2mm
CAPACITOR:size 1005
STRIP LINE WIDHT=0.5mm
C1～C3:56pF
C4, C5:10pF
★:Please short between Pin4 and ground near IC

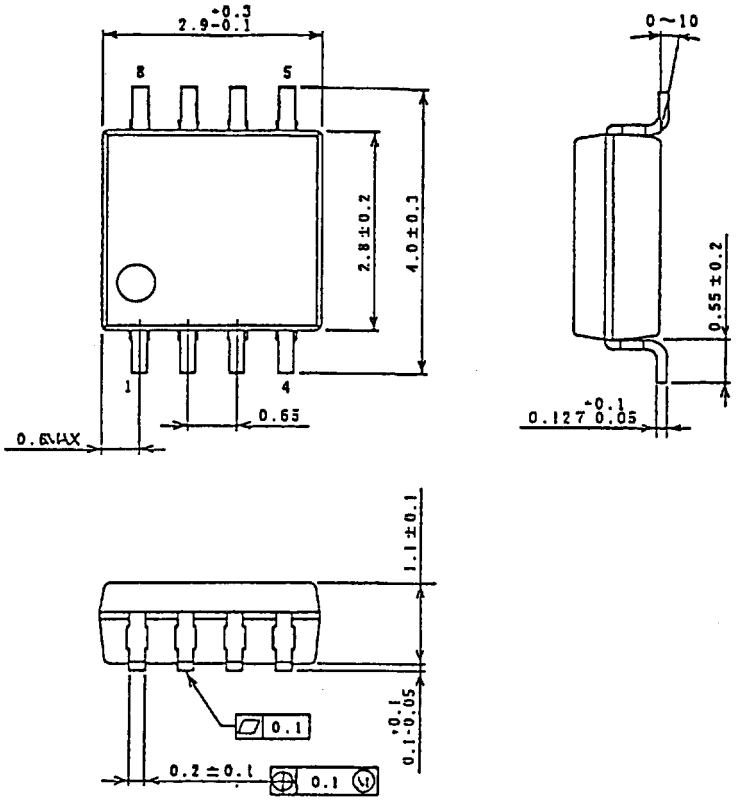
Usage precaution on devices

[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 900MHz. 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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- 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.