

# MEDIUM POWER AMPLIFIER GaAs MMIC

## ■GENERAL DESCRIPTION

NJG1304E is a GaAs MMIC designed mainly for driver amplifier of PHS base station in Japan.

This is a variable gain type with 20dB dynamic range. It features very low distortion and  $P_{ACP}$  is less than  $-70\text{dBc}$  at 17dBm output power, and enable low voltage and high efficiency operation.

Small Plastic mold Package are adopted.

## ■PACKAGE OUTLINE



**NJG1304E**

## ■FEATURES

- Voltage gain under low distortion
- Low voltage operation
- Low current consumption
- High gain
- Low distortion(ACP)
- Power Dissipation
- Reduction of Parasitic oscillation
- Input and output internal matching circuit
- Package

$V_{DD} = +3.0\text{V typ.}$

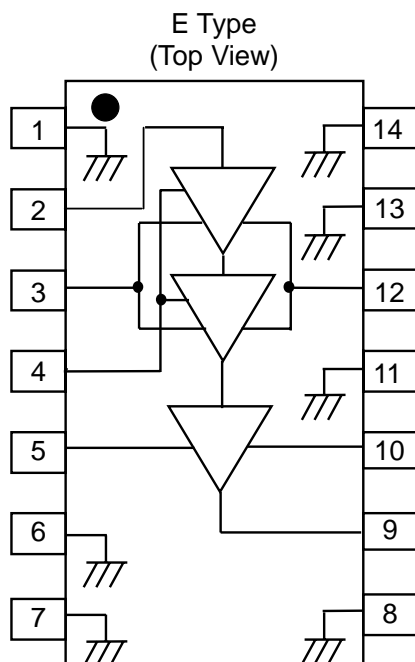
$I_{DD} = 180\text{mA typ. @}f = 1.9\text{GHz, } P_{out} = 17\text{dBm}$

Gain= 32dB

$P_{ACP} = -70\text{dBc typ. @}f = 1.9\text{GHz, } P_{OUT} = 17\text{dBm}$   
1000mW

EMP14

## ■PIN CONFIGURATION



### Pin Connection

- 1.GND
- 2.RF<sub>in</sub>
- 3.V<sub>GG1</sub>
- 4.V<sub>CONT</sub>
- 5.V<sub>GG2</sub>
- 6.GND
- 7.GND
- 8.GND
- 9.RF<sub>OUT</sub>
- 10.V<sub>DD2</sub>
- 11.GND
- 12.V<sub>DD1</sub>
- 13.GND
- 14.GND

# NJG1304E

## ■ABSOLUTE MAXIMUM RATINGS

( $T_a=+25^{\circ}\text{C}$ ,  $Z_s=Z_i=50\Omega$ )

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNITS
Drain Voltage	$V_{DD1}, V_{DD2}$	$V_{GG1}, V_{GG2}=-0.9\text{V}$	6.0	V
Gate Voltage	$V_{GG1}, V_{GG2}$	$V_{DD1}, V_{DD2}=3.0\text{V}$	-4.0	V
Gain Control Voltage	$V_{CONT}$	$V_{DD1}, V_{DD2}=3.0\text{V}$	-4.0	V
Input Power	$P_{in}$	$V_{DD1}, V_{DD2}=3.0\text{V}$ , $V_{GG1}, V_{GG2}=-0.9\text{V}$	3.0	dBm
Power Dissipation	$P_D$	At on PCB board	1000	mW
Operating Temperature	$T_{opr}$		-30 ~ +85	$^{\circ}\text{C}$
Storage Temperature	$T_{stg}$		-40 ~ +150	$^{\circ}\text{C}$

## ■ELECTRICAL CHARACTERISTICS

( $T_a=+25^{\circ}\text{C}$ ,  $Z_s=Z_i=50\Omega$ )

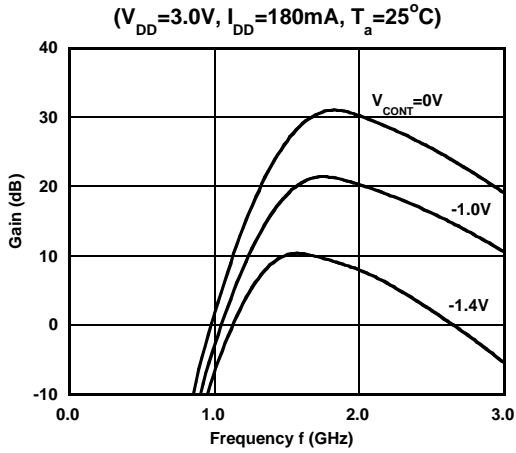
PARAMETER	SYMBOL	CONDITONS	MIN	TYP	MAX	UNITS
Operating Frequency	freq	$V_{DD1,2}=3.0\text{V}$	1.89	-	1.92	GHz
Drain Voltage	$V_{DD1,2}$		2.9	3.0	5.3	V
Gate Voltage	$V_{GG1,2}$	$V_{DD1,2}=3.0\text{V}$ , $I_{idle}=180\text{mA}$	-1.25	-0.9	-0.6	V
Idle Current *1	$I_{idle}$	$V_{DD1,2}=3.0\text{V}$ , No RF Signal	175	180	185	mA
Operating Current *1	$I_{DD}$	$V_{DD1,2}=3.0\text{V}$ , $P_{out}=21\text{dBm}$	180	195	205	mA
Gate Current *2	$I_{GG}$	$V_{DD1,2}=3.0\text{V}$ , $P_{out}=21\text{dBm}$	-150	-70	-	$\mu\text{A}$
Gain Control Terminal Current	$I_{CONT}$	$V_{DD1,2}=3.0\text{V}$ , $P_{out}=21\text{dBm}$ $-2.0 < V_{CONT} < 0.0\text{V}$	-5.0	-2.0	-	$\mu\text{A}$
Gain Control Voltage	$V_{CONT}$		-2.0	-	0	V
Small Signal Gain	Gain	$V_{DD1,2}=3.0\text{V}$ , $I_{idle}=180\text{mA}$	29	32	35	dB
Gain Flatness	$G_{flat}$	$V_{DD1,2}=3.0\text{V}$ , $I_{idle}=180\text{mA}$	0	0.5	1.0	dB
Gain Control Range	$G_{CONT}$	$V_{CONT}=-2\sim 0\text{V}$ , $V_{DD1,2}=3.0\text{V}$ $I_{idle}=180\text{mA}$	18	20	23	dB
Pout at 1dB Compression point	$P_{-1dB}$	$V_{DD1,2}=3.0\text{V}$	22	23	-	dBm
Adjacent Channel Leakage Power 1	$P_{acp1}$	$V_{DD1,2}=3.0\text{V}$ , $P_{out}=17\text{dBm}$ offset=600kHz $P_{in}; \pi/4$ DQPSK	-	-	-70	dBc
Adjacent Channel Leakage Power 2	$P_{acp2}$	$V_{DD1,2}=3.0\text{V}$ , $P_{out}=17\text{dBm}$ offset=900kHz $P_{in}; \pi/4$ DQPSK	-	-	-70	dBc
Adjacent Channel Leakage Power 1	$P_{acp1}$	$V_{DD1,2}=3.0\text{V}$ , $P_{out}=13\text{dBm}$ (Adjust $V_{cont}$ ), offset=600kHz $P_{in}=-7\text{dBm}$ ; $\pi/4$ DQPSK	-	-	-70	dBc
Adjacent Channel Leakage Power 2	$P_{acp2}$	$V_{DD1,2}=3.0\text{V}$ , $P_{out}=13\text{dBm}$ (Adjust $V_{cont}$ ), offset=900kHz $P_{in}=-7\text{dBm}$ ; $\pi/4$ DQPSK	-	-	-70	dBc
Harmonics	$P_{SP}$	$V_{DD1,2}=3.0\text{V}$ , $P_{out}=21\text{dBm}$	-	-35	-30	dBc
Input VSWR	$VSWR_i$	$V_{DD1,2}=3.0\text{V}$	-	-	2.2	
Load VSWR Tolerance	-	$V_{DD1,2}=3.0\text{V}$ , $P_{out}=21\text{dBm}$ Load VSWR=4:1, All Phase	Parasitic Oscillation for Fundamental Signal Level :=<-60dBc			

\*1: $V_{DD1}$  Terminal  $V_{DD2}$  Terminal Total Current

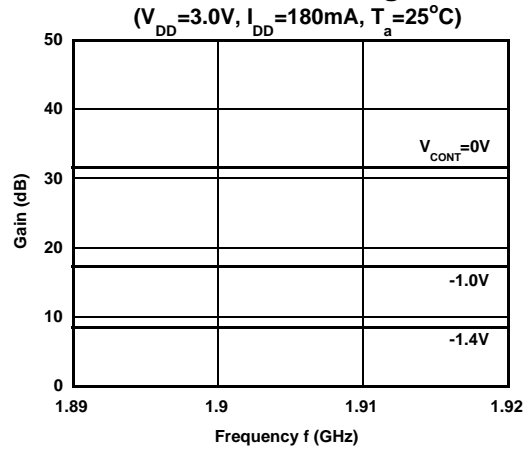
\*2: $V_{GG1}$  Terminal  $V_{GG2}$  Terminal Total Current

## TYPICAL CHARACTERISTICS

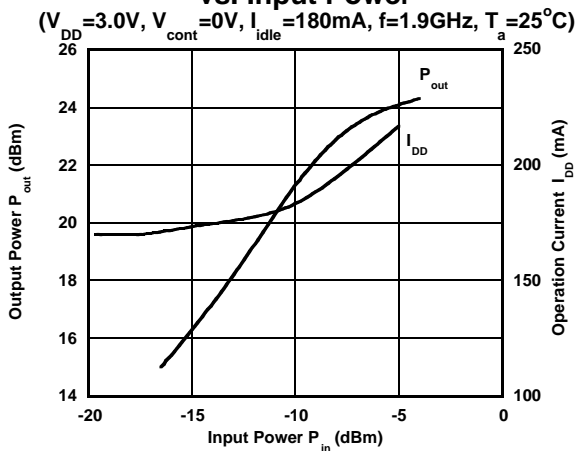
### Gain vs. Frequency vs. Control Voltage



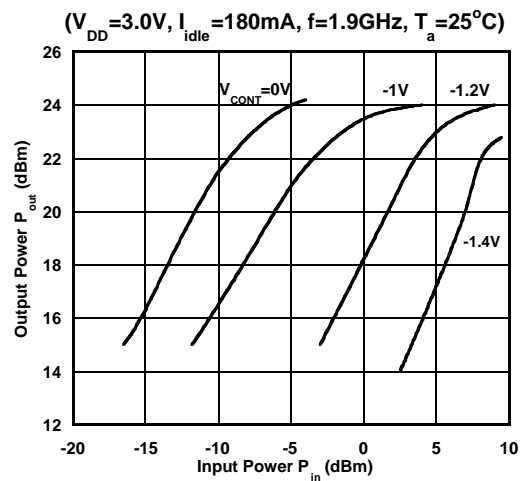
### Gain vs. PHS Band Frequency vs. Control Voltage



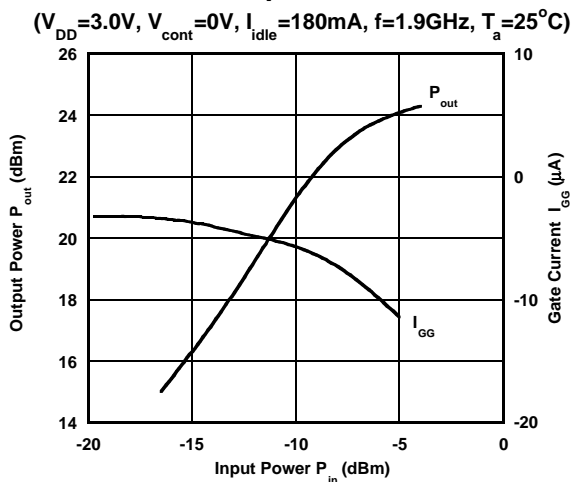
### Output Power, Operating Current vs. Input Power



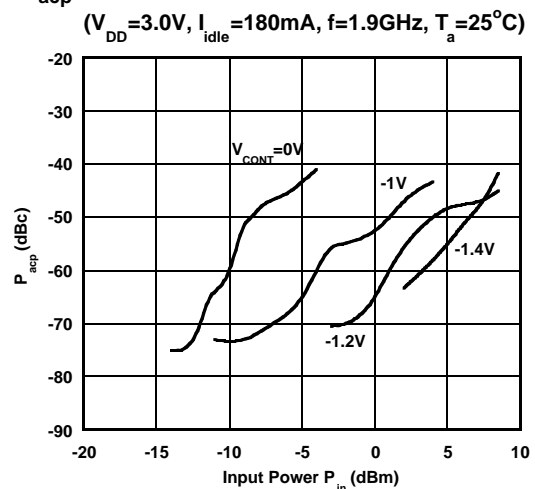
### Output Power vs. Input Power vs. Control Voltage



### Output Power, Gate Current vs. Input Power



### $P_{acc}$ vs. Input Power vs. Control Voltage

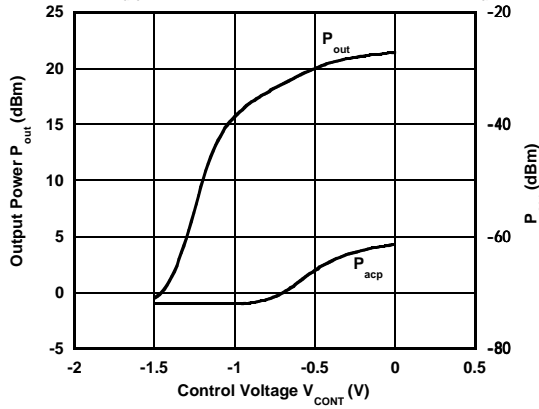


# NJG1304E

## TYPICAL CHARACTERISTICS

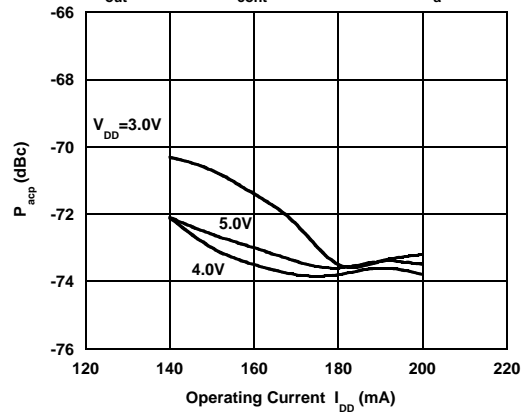
**Output Power,  $P_{out}$  vs. Control Voltage**

( $V_{DD}=3.0V$ ,  $I_{idle}=180mA$ ,  $f=1.9GHz$ ,  $P_{in}=-11dBm$ ,  $T_a=25^\circ C$ )



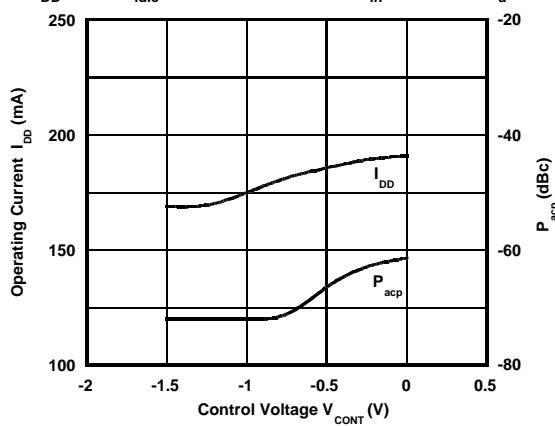
**$P_{acp}$  vs. Operating Current vs.  $V_{DD}$**

( $P_{out}=17dBm$ ,  $V_{cont}=0V$ ,  $f=1.9GHz$ ,  $T_a=25^\circ C$ )



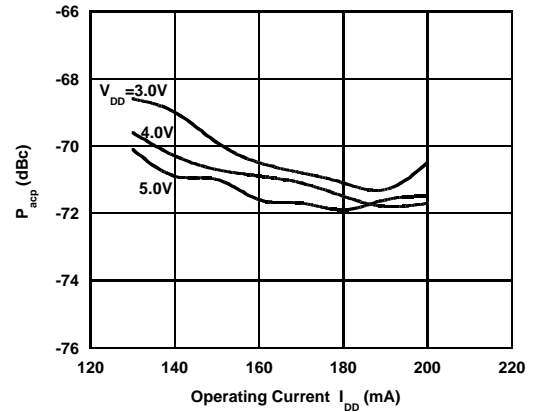
**Operating Current,  $I_{DD}$  vs. Control Voltage**

( $V_{DD}=3.0V$ ,  $I_{idle}=180mA$ ,  $f=1.9GHz$ ,  $P_{in}=-11dBm$ ,  $T_a=25^\circ C$ )



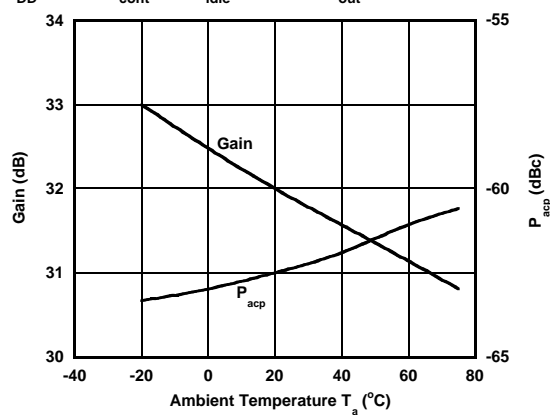
**$P_{acp}$  vs. Operating Current vs.  $V_{DD}$**

( $P_{out}=13dBm$ ,  $P_{in}=-7dBm$ ,  $V_{cont}=-1.1V$ ,  $f=1.9GHz$ ,  $T_a=25^\circ C$ )



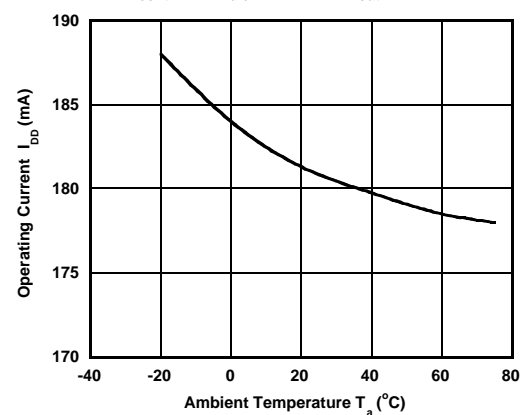
**Gain,  $P_{acp}$  vs. Ambient Temperature**

( $V_{DD}=3.0V$ ,  $V_{cont}=0V$ ,  $I_{idle}=180mA$ ,  $P_{out}=21dBm$ ,  $f=1.9GHz$ )

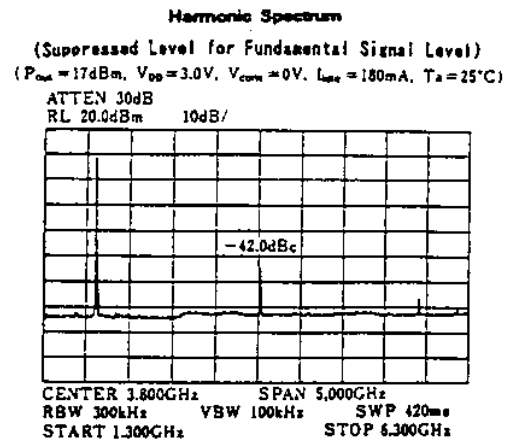
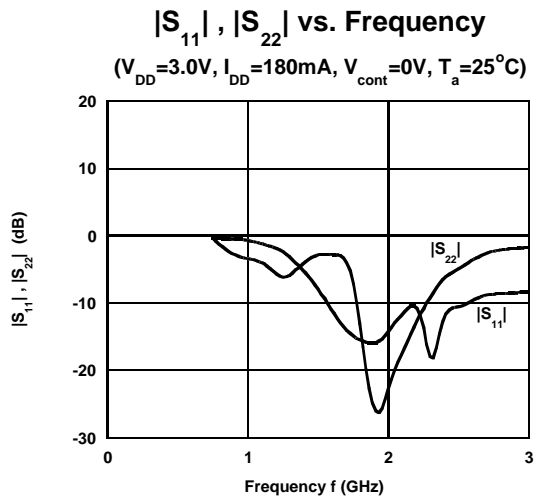


**Operating Current vs. Ambient Temperature**

( $V_{DD}=3.0V$ ,  $V_{cont}=0V$ ,  $I_{idle}=180mA$ ,  $P_{out}=21dBm$ ,  $f=1.9GHz$ )



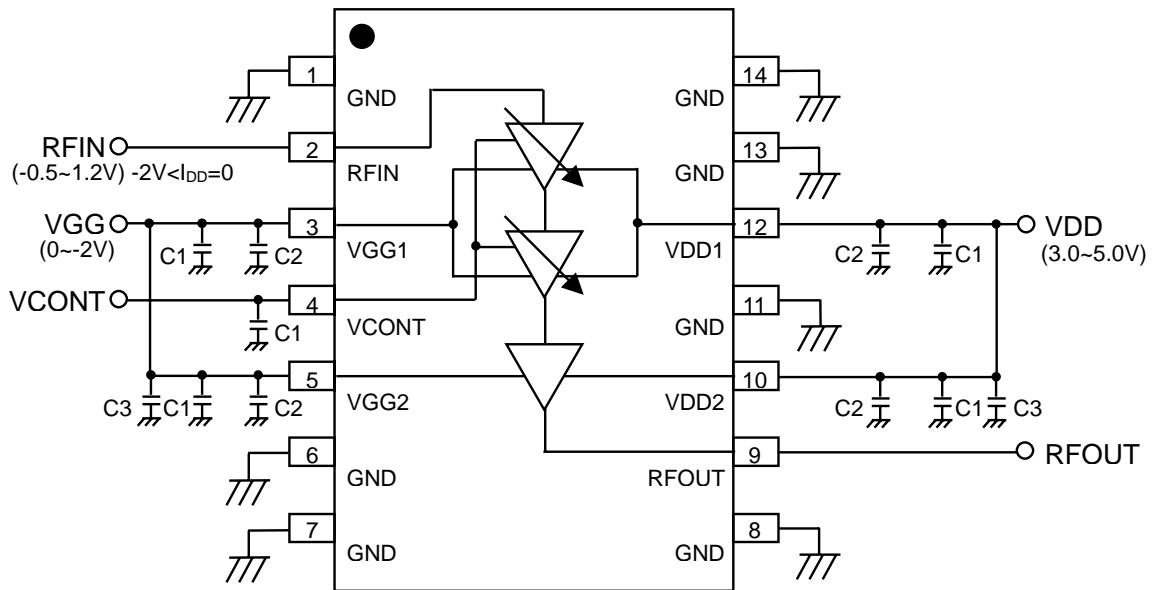
## ■ TYPICAL CHARACTERISTICS



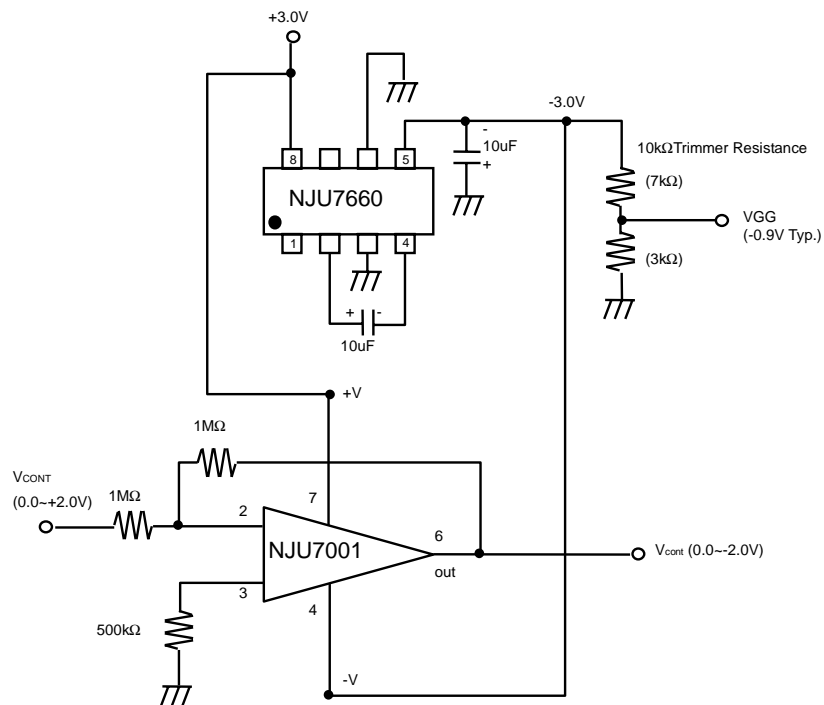
;All adjacent channel leakage power used in these evaluations are those of 600kHz offset from fundamental wave at PHS operating condition( $\pi/4$ QPSK modulation)

# NJG1304E

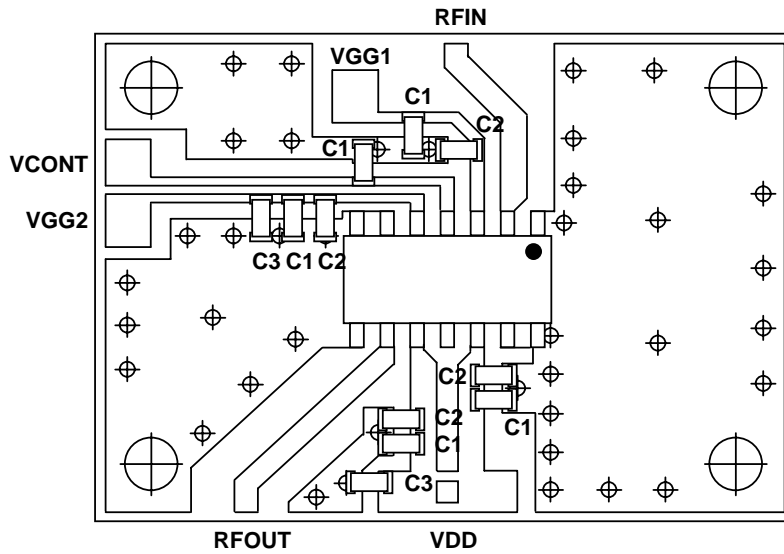
## RECOMMENDED CIRCUIT



## RECOMMENDED CIRCUIT TO GENERATE NEGATIVE VOLTAGE



## RECOMMENDED PCB DESIGN



PCB: FR4, t=0.5mm  
 MICROSTRIP LINE WIDTH=1mm  
 PCB SIZE: 30.0x25.5mm

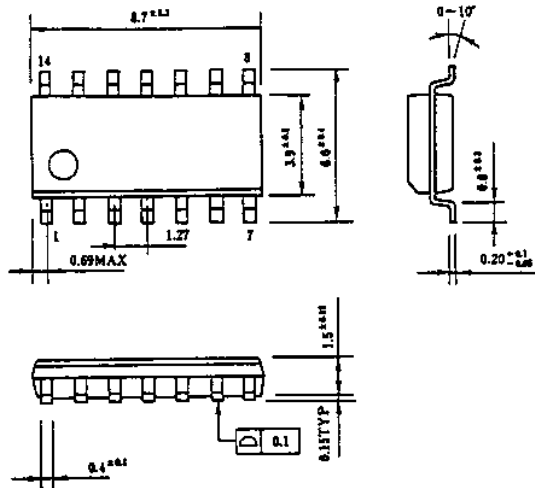
The reflow method is recommended for this device to attach on PCB.

### Parts list

Parts ID	CONSTANT	COMMENT
C1	1000pF	MURATA (GRM36, 1005size)
C2	33pF	MURATA (GRM36, 1005size)
C3	1uF	MURATA (GRM36, 1005size)

# NJG1304E

## ■PAKAGE OUTLINE(EMP14)



Lead material	: Copper
Lead surface finish	: Solder plating
Molding material	: Epoxy resin
UNIT	: mm
Weight	: 130mg

### 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.

### [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.

This product may be damaged with electric static discharge (ESD) or spike voltage. Please handle with care to avoid these damages.