GaAs POWER AMPLIFIER IC

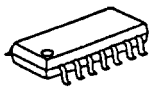
■ GENERAL DESCRIPTION

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 -70dBc at 17 dBm output power , and enables low voltage and high efficiency operation.

Small Plastic mold Package are adopted.

■ PACKAGE OUTLINE



NJG1304E

■ APPLICATIONS

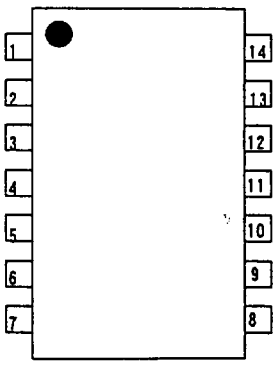
- PHS base station etc.

■ FEATURES

- Variable gain under low distortion
- Low voltage operation (V_{DD}=3.0V)
- Input and output internal matching circuits
- High gain (32dB Typ.)
- Low distortion (P_{acp}=-70dBc Typ.@1.9GHz,17dBm)
- Low current consumption (I_{DD}=180mA Typ.@1.9GHz,17dBm)
- Reduction of Parasitic oscillation
- EMP 14 Maximum Power Dissipation: 1000mW(Tj=150℃,PCB: 24*30*1.0mm FR4)

■ PIN CONFIGURATION

(Top View)



Pin Connection

1.GND	8.GND
2.RF_{in}	9.RF_{out}
3.V_{GG1}	10.V_{DD2}
4.V_{cont}	11.GND
5.V_{GG2}	12.V_{DD1}
6.GND	13.GND
7.GND	14.GND

■ ABSOLUTE MAXIMUM RATINGS

(Z_s=Z_o=50ohm, T_a=25℃)

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNIT
Drain Voltage	V_{DD1},V_{DD2}	$V_{GG1,2}$=-0.9V	6	V
Gate Voltage	V_{GG1},V_{GG2}	$V_{DD1,2}$=3.0V	-4	V
Gain control voltage	V_{cont}	$V_{DD1,2}$=3.0V	-4	V
Input Power	P_{in}	$V_{DD1,2}$=3.0V,$V_{GG1,2}$=-0.9V	3	dBm
Power Dissipation	P_D	24*30*1.0mm PCB : FR4, T_j=150℃	1000	mW
Operating Temperature	T_{opr}		-30～+85	℃
Storage Temperature	T_{stg}		-40～+150	℃

■ ELECTRICAL CHARACTERISTICS

(f=1.9GHz,Z_s=Z_o=50ohm,Ta=25℃)

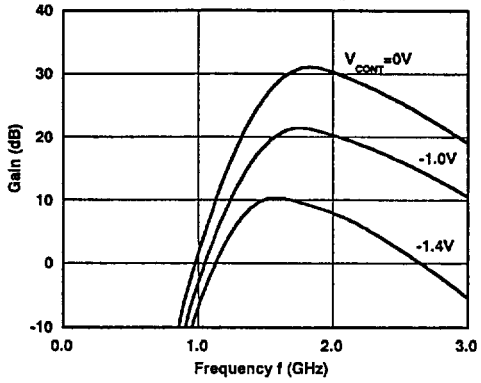
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Frequency	freq	$V_{DD1,2}$=3.0V	1.89	-	1.92	GHz
Drain Voltage	$V_{DD1,2}$		2.9	3.0	5.3	V
Gate Voltage	$V_{GG1,2}$	$V_{DD1,2}$=3.0V,I_{idle}=180mA	-1.25	-0.9	-0.6	V
Idle Current *1	I_{idle}	$V_{DD1,2}$=3.0V, No RF Signal	175	180	185	mA
Operating Current *1	I_{DD}	P_{out}=17dBm,$V_{DD1,2}$=3.0V	170	180	190	mA
Gate Current *2	I_{GG}	P_{out}=17dBm,$V_{DD1,2}$=3.0V	-150	-70	-	uA
Gain Control Terminal Current	I_{cont}	P_{out}=17dBm,$V_{DD1,2}$=3.0V -2.0V<V_{cont}<0.0V	-5	-2	-	uA
Gain Control Voltage			-2.0	-	0	V
Small Signal Gain	Gain	$V_{DD1,2}$=3.0V,I_{idle}=180mA	29	32	35	dB
Gain Flatness	G_{flat}	$V_{DD1,2}$=3.0V,I_{idle}=180mA	0.0	0.5	1.0	dB
Gain Control Range	G_{cont}	Vcont=2～0V,$V_{DD1,2}$=3.0V I_{idle}=180mA	18	20	23	dB
Pout at 1dB Compression	P_{-1dB}	$V_{DD1,2}$=3.0V	22	23	-	dBm
Adjacent Channel Leakage Power ①	P_{acp1}	P_{out}=17dBm,offset=600kHz, P_{in}; π/4 QPSK,$V_{DD1,2}$=3.0V	-	-	-70	dBc
Adjacent Channel Leakage Power ②	P_{acp2}	P_{out}=17dBm,offset=900kHz, P_{in}; π/4 QPSK,$V_{DD1,2}$=3.0V	-	-	-70	dBc
Adjacent Channel Leakage Power ③	P_{acp3}	P_{in}=-7dBm,offset=600kHz P_{out}=13dBm (Adjust V_{cont})	-	-	-70	dBc
Adjacent Channel Leakage Power ④	P_{acp4}	P_{in}; π/4 QPSK,$V_{DD1,2}$=3.0V P_{in}=-7dBm,offset=900kHz P_{out}=13dBm (Adjust V_{cont})	-	-	-70	dBc
Harmonics	P_{sp}	P_{in}; π/4 QPSK,$V_{DD1,2}$=3.0V P_{out}=21dBm,$V_{DD1,2}$=3.0V	-	-35	-30	dBc
Input VSWR	$VSWR_i$	$V_{DD1,2}$=3.0V	-	-	2.2	
Load VSWR Tolerance		P_{out}=21dBm,$V_{DD1,2}$=3.0V Load VSWR=4:1,All Phase	Parasitic Oscillation for Fundamental Signal Level : ≦-60dBc			

*1 ; V_{DD1} Terminal and V_{DD2} Terminal Total Current
*2 ; V_{GG1} Terminal and V_{GG2} Terminal Total Current

■TYPICAL CHARACTERISTICS

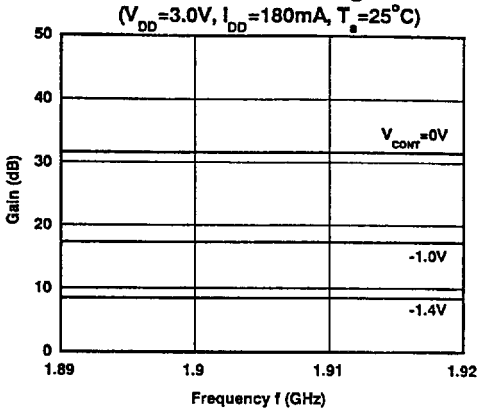
Gain vs. Frequency vs. Control Voltage

(V_{DD}=3.0V, I_{DD}=180mA, T_a=25°C)



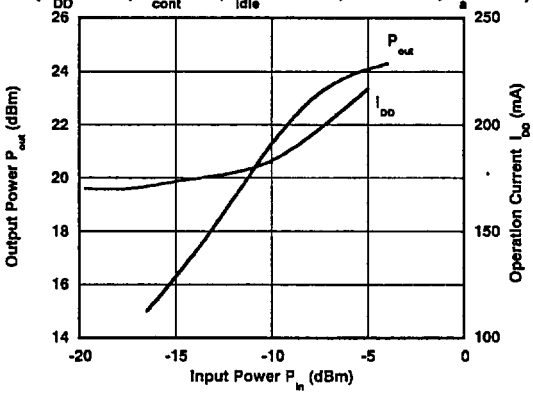
Gain vs PHS Band Frequency vs. Control Voltage

(V_{DD}=3.0V, I_{DD}=180mA, T_a=25°C)



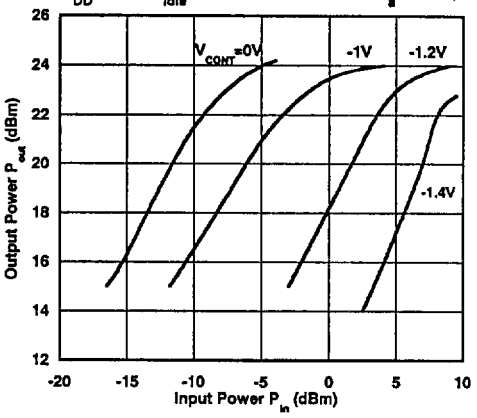
Output Power, Operating Current vs. Input Power

(V_{DD}=3.0V, V_{cont}=0V, I_{idle}=180mA, f=1.9GHz, T_a=25°C)



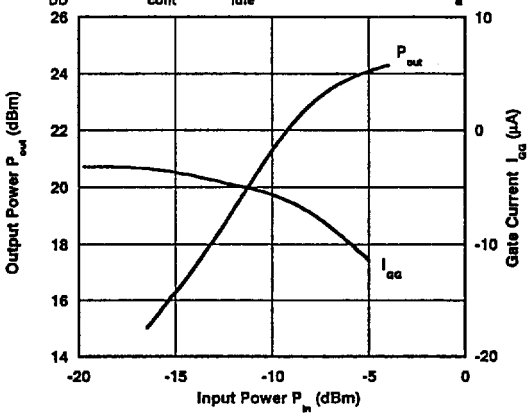
Output Power vs. Input Power vs. Control Voltage

(V_{DD}=3.0V, I_{idle}=180mA, f=1.9GHz, T_a=25°C)



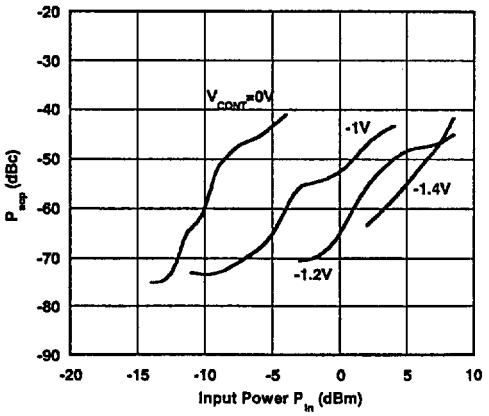
Output Power, Gate Current vs. Input Power

(V_{DD}=3.0V, V_{cont}=0V, I_{idle}=180mA, f=1.9GHz, T_a=25°C)



P_{acp} vs. Input Power vs. Control Voltage

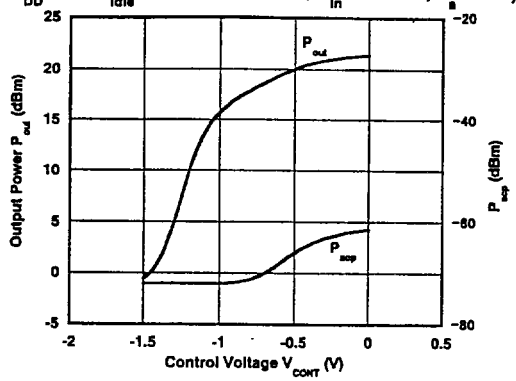
(V_{DD}=3.0V, I_{idle}=180mA, f=1.9GHz, T_a=25°C)



■TYPICAL CHARACTERISTICS

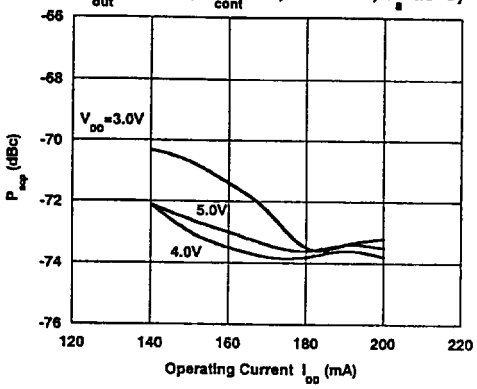
Output Power, P_{acp} vs. Control Voltage

(V_{DD}=3.0V, I_{Idle}=180mA, f=1.9GHz, P_{in}=-11dBm, T_a=25°C)



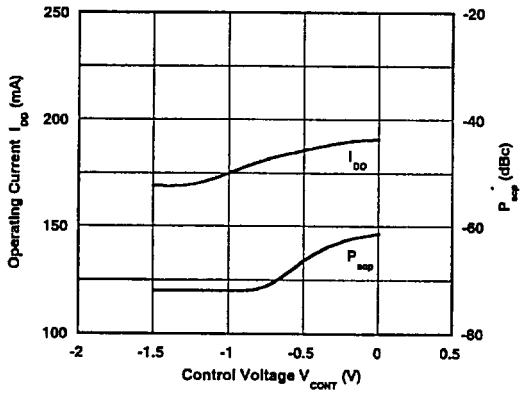
P_{acp} vs. Operating Current vs. V_{DD}

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



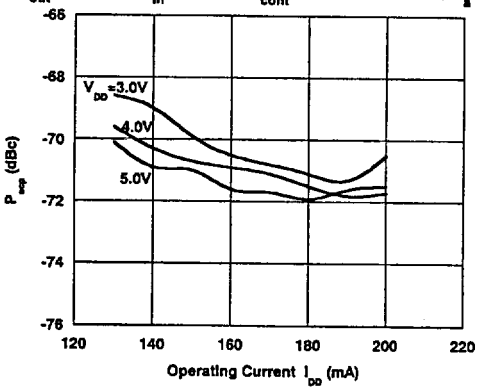
Operating Current, P_{acp} vs Control Voltage

(V_{DD}=3.0V, I_{Idle}=180mA, f=1.9GHz, P_{in}=-11dBm, T_a=25°C)



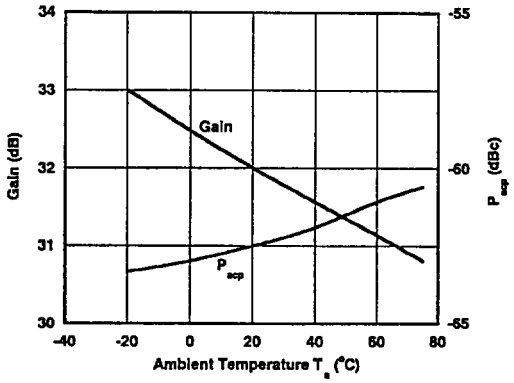
P_{acp} vs. Operating Current vs. V_{DD}

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



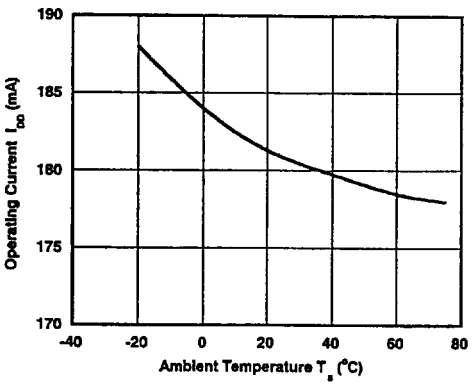
Gain, P_{acp} vs. Ambient Temperature

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



Operating Current vs. Ambient Temperature

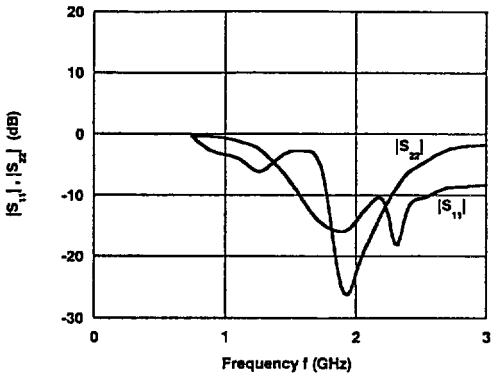
(V_{DD}=3.0V, V_{cont}=0V, I_{Idle}=180mA, P_{out}=21dBm, f=1.9GHz)



TYPICAL CHARACTERISTICS

$|S_{11}|$, $|S_{22}|$ vs. Frequency

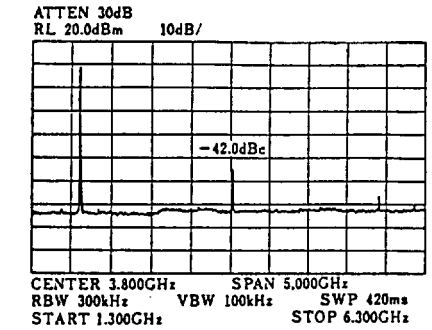
(V_{DD}=3.0V, I_{DD}=180mA, T_a=25°C, Vcont=0V)



Harmonic Spectrum

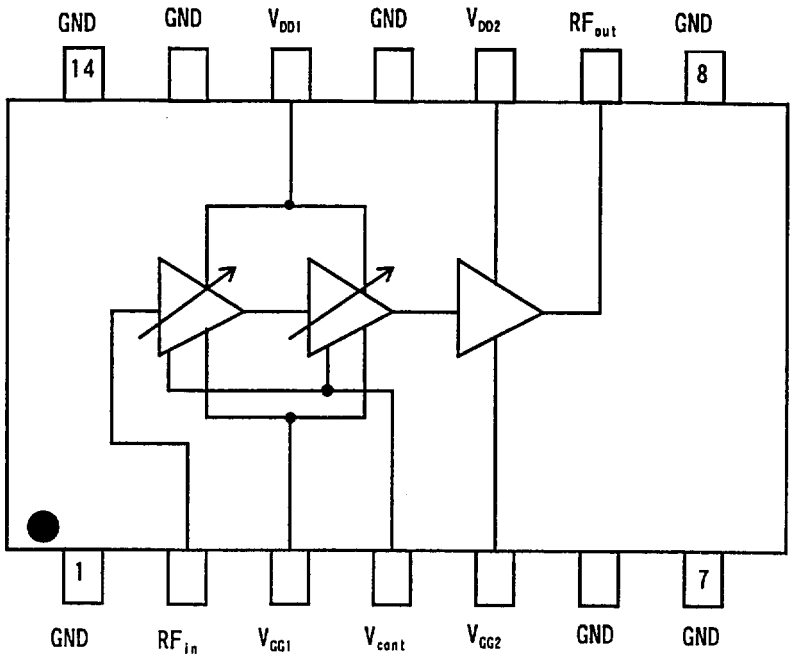
(Suppressed Level for Fundamental Signal Level)

(P_{out}=17dBm, V_{DD}=3.0V, V_{cont}=0V, I_{total}=180mA, Ta=25°C)

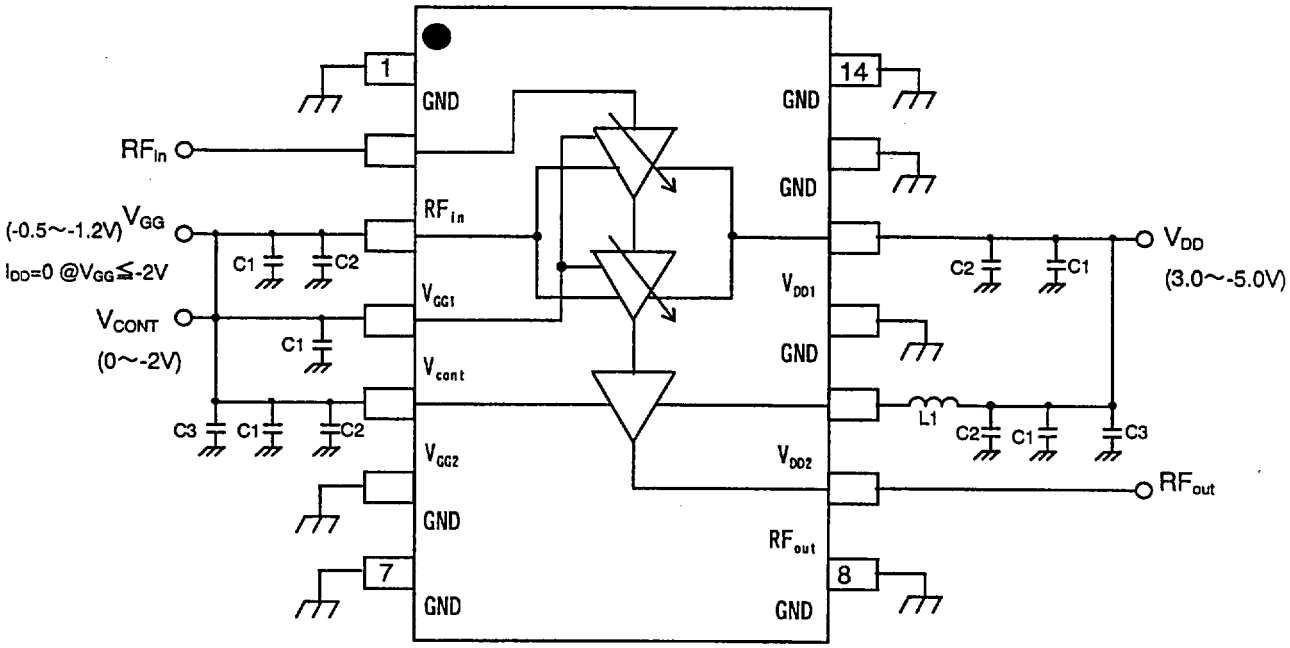


All adjacent channel leakege power used in these characteristics are those of 600KHz offset for fundamental wave at PHS operating condition(π/4 QPSK)

■ BLOCK DIAGRAM

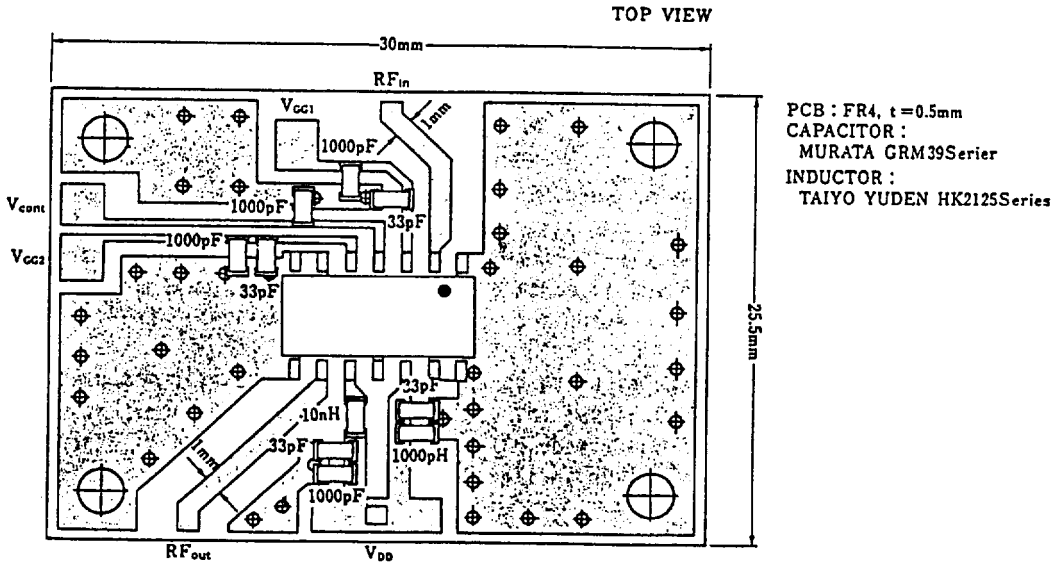


■RECOMMENDED CIRCUIT



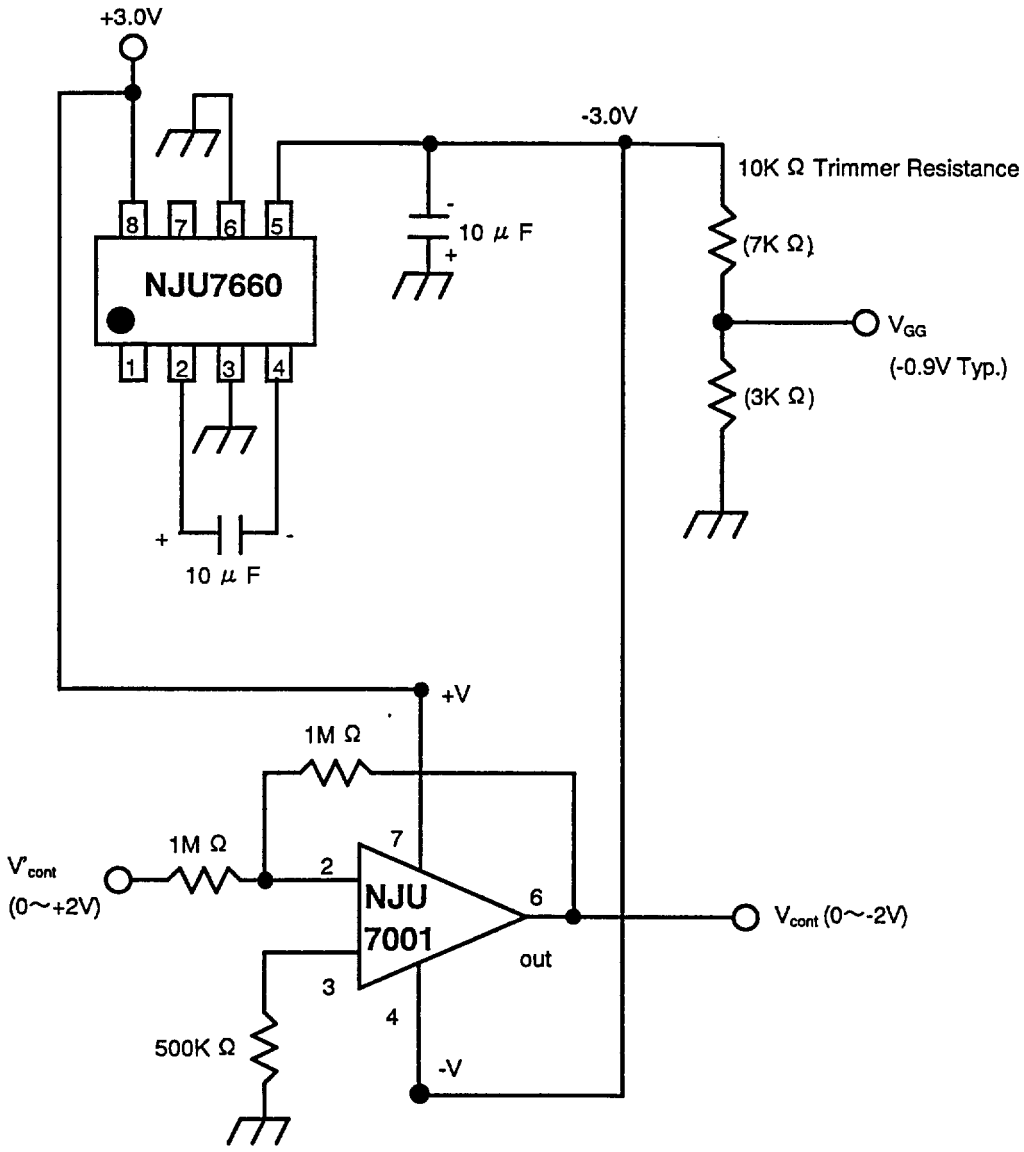
C1:1000pF
C2:33pF
C3:1 μ F
C4:10nH

■RECOMMENDED PCB



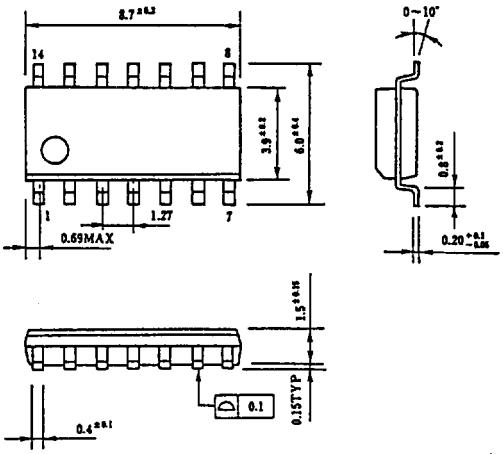
The reflow method is recommended to install this device to PCB.

■RECOMMENDED PCB



■PACKAGE OUTLINE

EMP14



UNIT:mm

Caution on using the products

A GaAs is used in this product. 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 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 product may be broken with static electric discharge or serge voltage. Therefore, please note a handling.

The other caution item

- The product specifications and descriptions listed in this catalog are subject to change at any time, without notice.
- 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 before.