SINGLE-SUPPLY DUAL OPERATIONAL AMPLIFIER

■ GENERAL DESCRIPTION

The NJM2904C consists of two independent, high gain, internally frequency compensated operation amplifiers, which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

Application areas include transducer amplifiers, DC gain blocks, and all the conventional op amp circuits, which now can be more easily implemented in single power supply systems. For example, the NJM2904C can be directly operated off of the standard +5V power supply voltage, which is used in digital systems and will easily provide the required interface electronics without requiring the additional ±15V power supplies.

■ PACKAGE OUTLINE

NJM2904CG
(SOP8)

NJM2904CM
(DMP8)

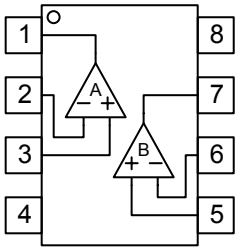
NJM2904CRB1 (U.D)
(MSOP8 (TVSP8))

■ FEATURES

- Single Supply
- Operating Voltage +3V to +32V
- Low Operating Current 0.7mA typ.
- Slew Rate 0.6V/μs typ.
- Bipolar Technology
- Package Outline SOP8, DMP8
  MSOP8 (TVSP8)* (U.D.)
  *MEET JEDEC MO-187-DA / THIN TYPE
- Internal ESD protection
  Human body model (HBM) ±2000V typ.
- Wide temperature range -40°C to +105°C

■ PIN CONFIGURATION

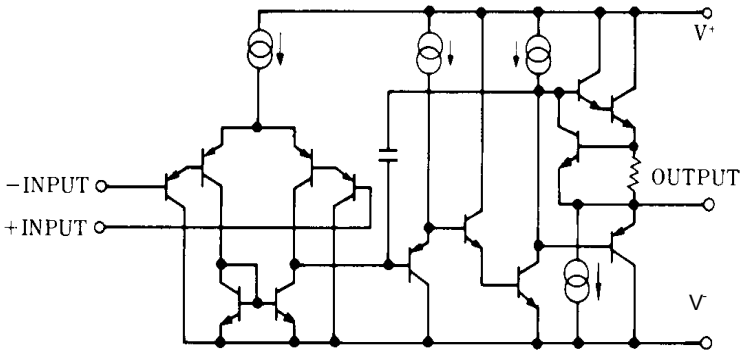
(Top View)



PIN FUNCTION
1.A OUTPUT
2.A - INPUT
3.A + INPUT
4.V^-
5.B + INPUT
6.B - INPUT
7.B OUTPUT
8.V^+

NJM2904CG
NJM2904CM
NJM2904CRB1

■ EQUIVALENT CIRCUIT (1/2 Shown)



■ ABSOLUTE MAXIMUM RATINGS

(Ta=25˚C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+ ($V^{+/}$ V^-)	32 (or ±16V)	V
Differential Input Voltage (Note1)	V_{ID}	±32	V
Input Voltage (Note2)	V_{IN}	V^- - 0.3 to V^- + 32	V
Output Terminal Input Voltage	Vo	V^- - 0.3 to V^+ +0.3	V
Power Dissipation	P_D	SOP : 690 (Note3) 1000(Note4) DMP : 470 (Note3) 600 (Note4) MSOP : TBD	mW
Operating Temperature Range	T_{opr}	-40 to +105	˚C
Storage Temperature Range	T_{stg}	-65 to +150	˚C

(Note1)Differential voltage is the voltage difference between +INPUT and -INPUT.
(Note2) Input voltage is the voltage should be allowed to apply to the input terminal independent of the magnitude of V+.
The normal operation will establish when any input is within the Common Mode Input Voltage Range of electrical characteristics.
(Note3) EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 2layers, FR-4) mounting
(Note4) EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 4layers, FR-4) mounting

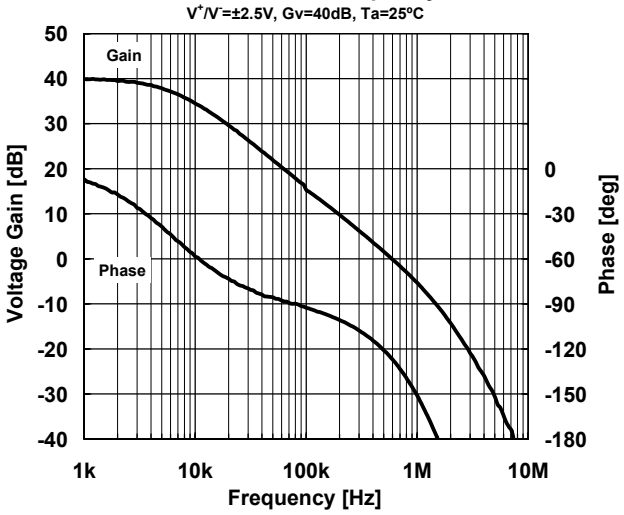
■ELECTRICAL CARACTERISTICS

(V+=5V, V-=0V, Ta=25ºC, unless otherwise noted.)

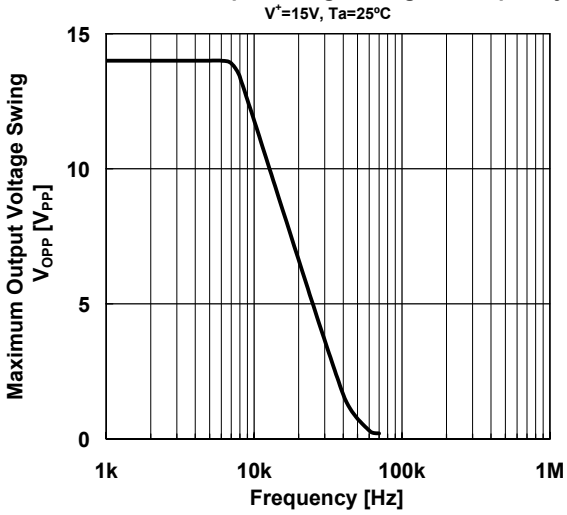
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I_{CC}	V^+=5V, no signal	-	0.7	1.2	mA
		V^+=30V, no signal	-	-	2	mA
Input Offset Voltage	V_{IO}	R_S=0Ω	-	0.5	7	mV
Input Bias Current	I_B		-	20	150	nA
Input Offset Current	I_{IO}		-	2	30	nA
Large Signal Voltage Gain	A_V	R_L≥2kΩ	94	100	-	dB
Supply Voltage Rejection Ratio	SVR	V^+=5 to 30V,Rs<10kΩ	65	100	-	dB
Input Common Mode Voltage Range	V_{ICM}	V^+=30V, CMR>70dB	0	-	V^+-1.5	V
Common Mode Rejection Ratio	CMR	Rs<10kΩ	70	100	-	dB
Output Source Current	I_{SOURCE}	V^+=15V,Vo=+2V, V_{id}=1V	20	40	-	mA
Output Sink Current	I_{SINK}	V^+=15V,Vo=+2V,V_{id}=1V	10	20	-	mA
		V^+=15V,Vo=+0.2V,V_{id}=1V	12	50	-	µA
High level output voltage	V_{OH}	R_L=2kΩ,V^+=30V	26	27	-	V
		R_L=10kΩ,V^+=30V	27	28	-	V
Low level output voltage	V_{OL}	R_L=10kΩ	-	5	20	mV
Slew Rate	SR	V^+=15V,V_{IN}=0.5 to 3V,C_L=100pF	-	0.6	-	V/µs
Gain Band Width Product	GBP	V^+=30V,f=100kHz,V_{IN}=10mVrms,R_L=2kΩ,C_L=100pF	-	1.1	-	MHz
Total Harmonic Distortions	THD	f=1kHz,G_V=20dB,R_L=2kΩ,V_o=2V_{pp},C_L=100pF	-	0.02	-	%
Equivalent input noise voltage	e_n	f=1kHz, Rs =100Ω,V^+=30V	-	30	-	nV/√Hz
Channel Separation	CS	1kHz< f <10kHz	-	120	-	dB

■ TYPICAL CHARACTERISTICS

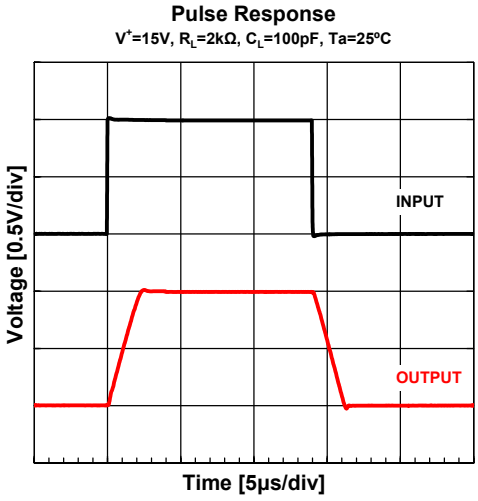
Gain/Phase vs. Frequency



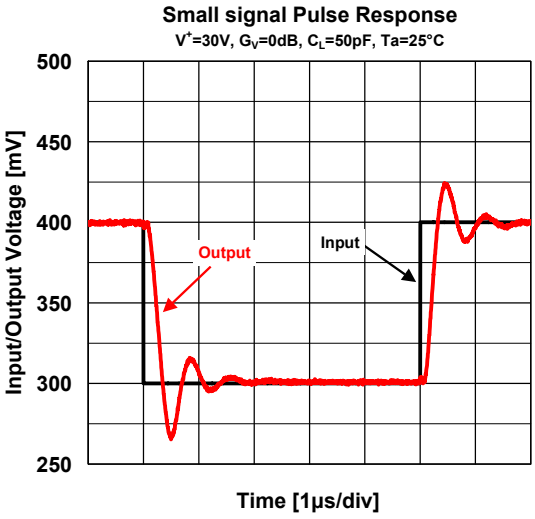
Maximum Output Voltage Swing vs. Frequency



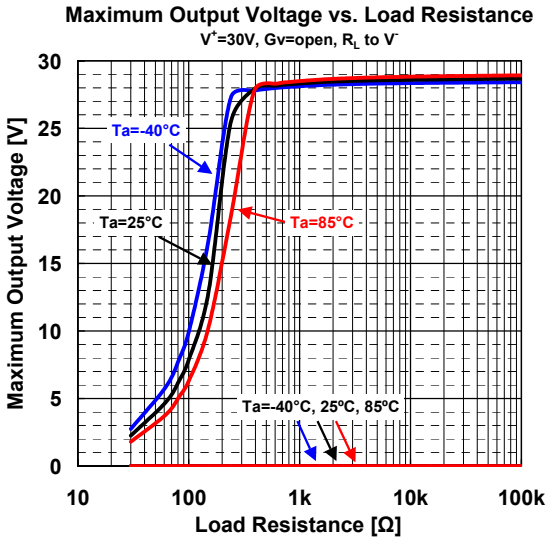
Pulse Response



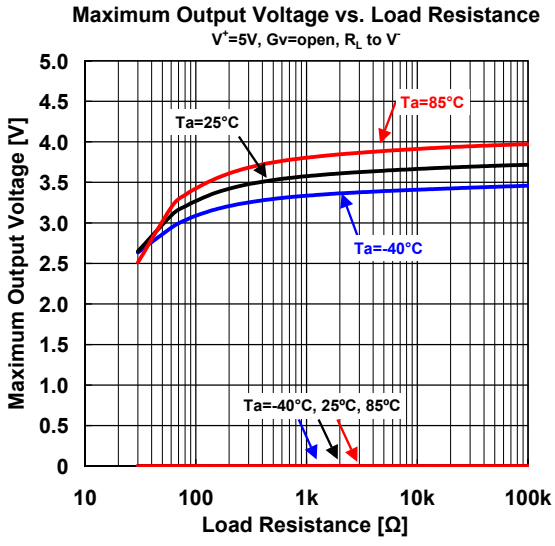
Small signal Pulse Response



Maximum Output Voltage vs. Load Resistance

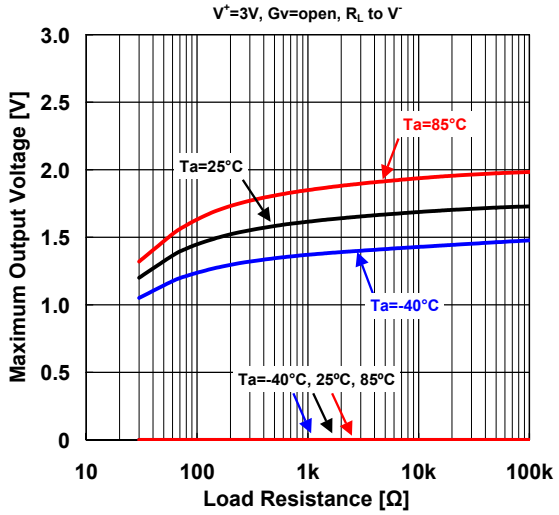


Maximum Output Voltage vs. Load Resistance

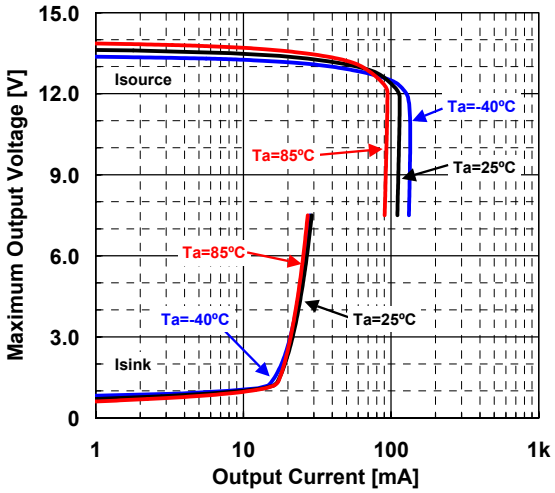


■ TYPICAL CHARACTERISTICS

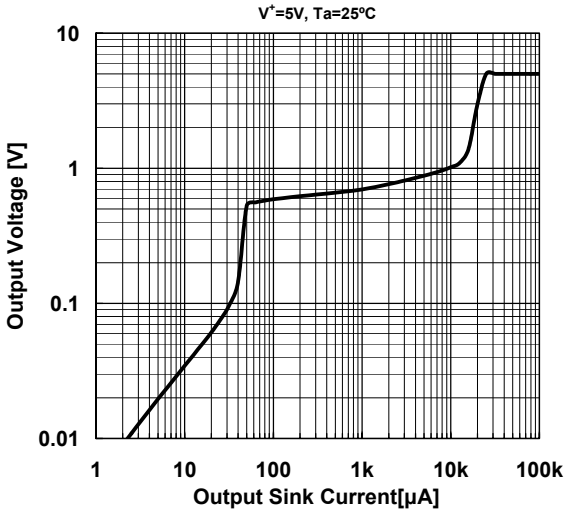
Maximum Output Voltage vs. Load Resistance



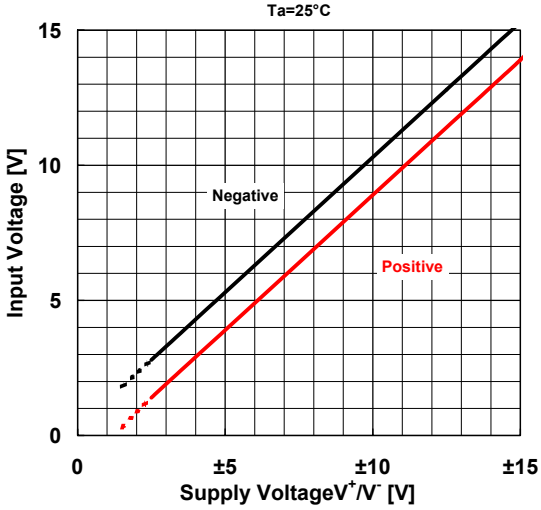
Maximum Output Voltage vs. Output Current



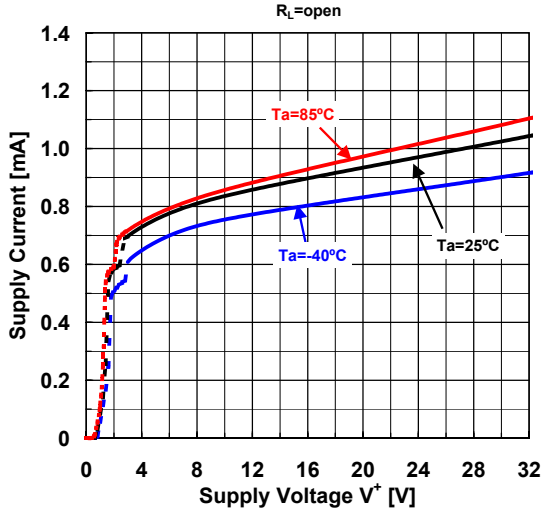
Output Voltage vs. Output Sink Current



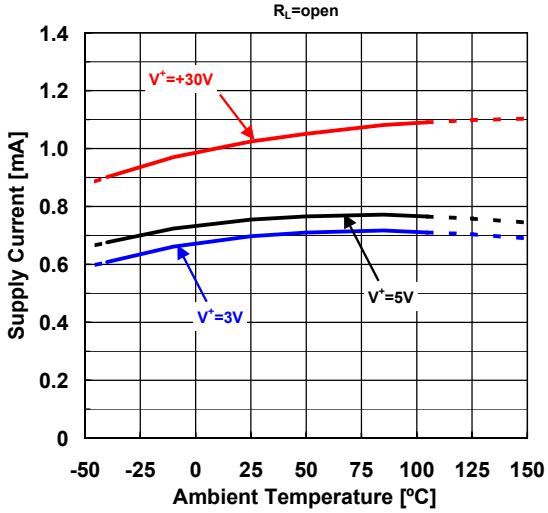
Input Voltage Range vs. Supply Voltage



Supply Current vs. Supply Voltage

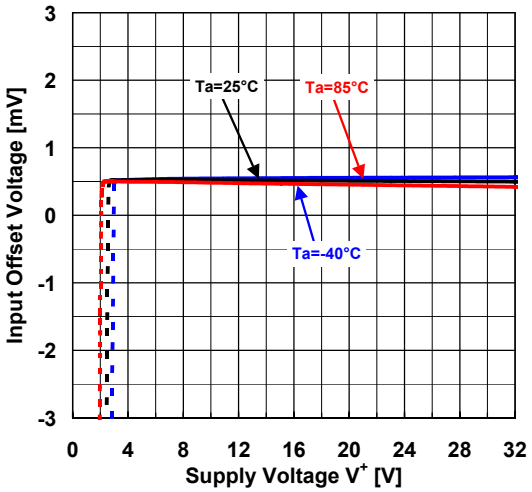


Supply Current vs. Temperature

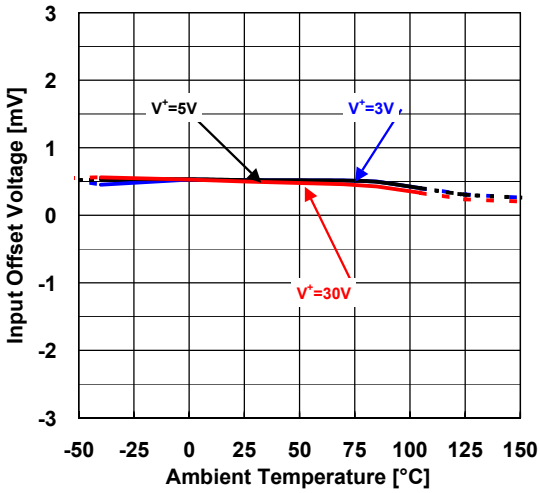


■ TYPICAL CHARACTERISTICS

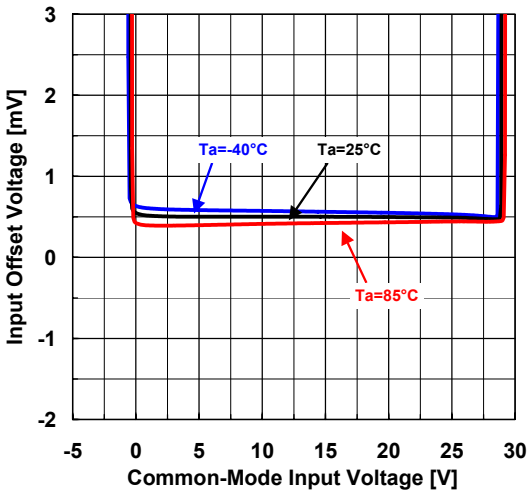
Input Offset Voltage vs. Supply Voltage
$V_{CM}=V^+/2$



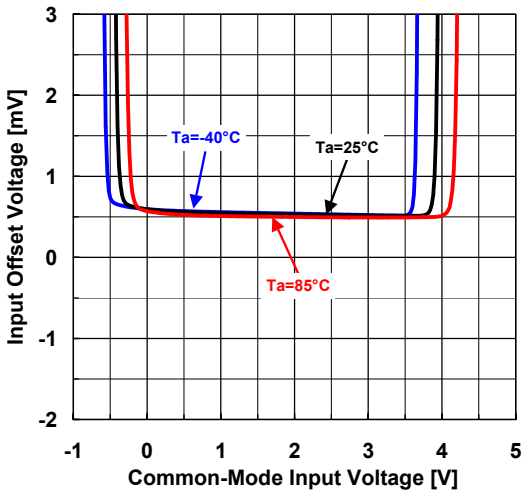
Input Offset Voltage vs. Temperature
$V_{CM}=V^+/2$



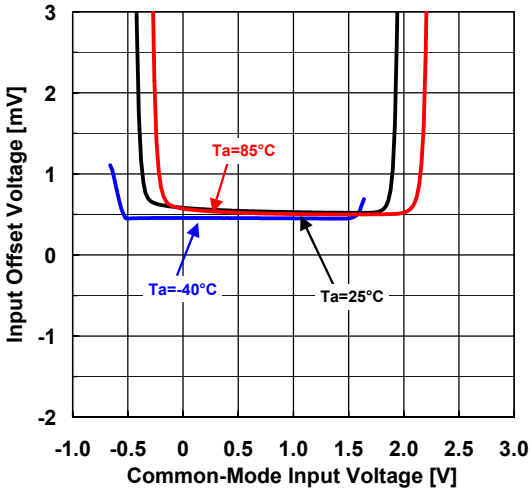
Input Offset Voltage
vs. Common-Mode Input Voltage
$V^+=30V$



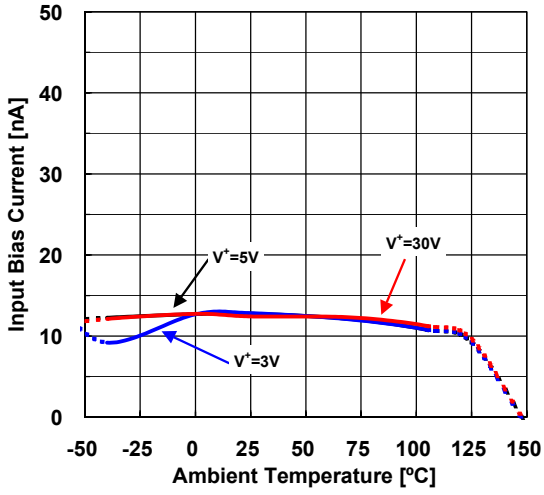
Input Offset Voltage
vs. Common-Mode Input Voltage
$V^+=5V$



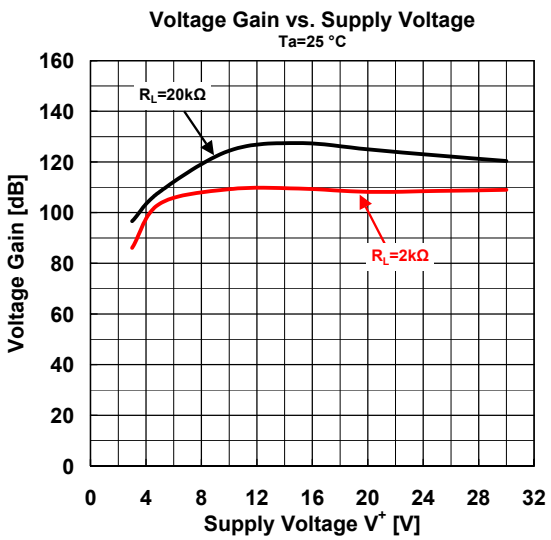
Input Offset Voltage
vs. Common-Mode Input Voltage
$V^+=3V$

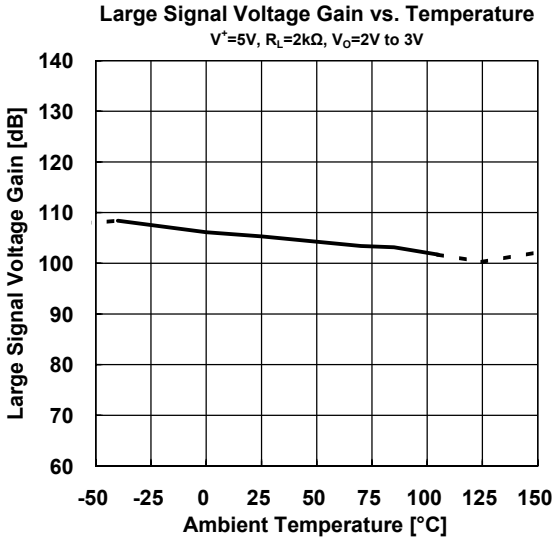


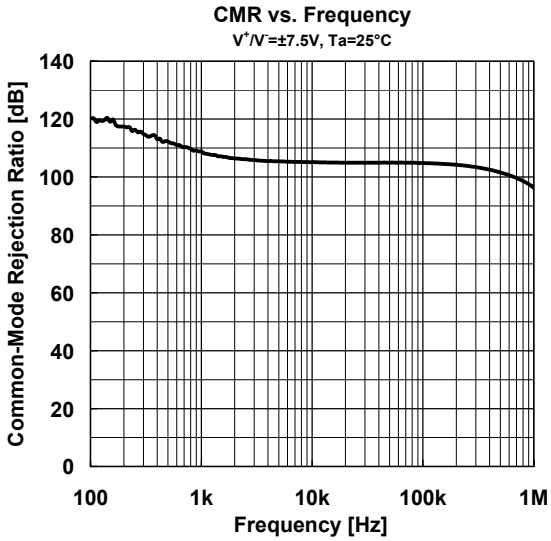
Input Bias Current vs. Temperature
$V_{CM}=V^+/2$

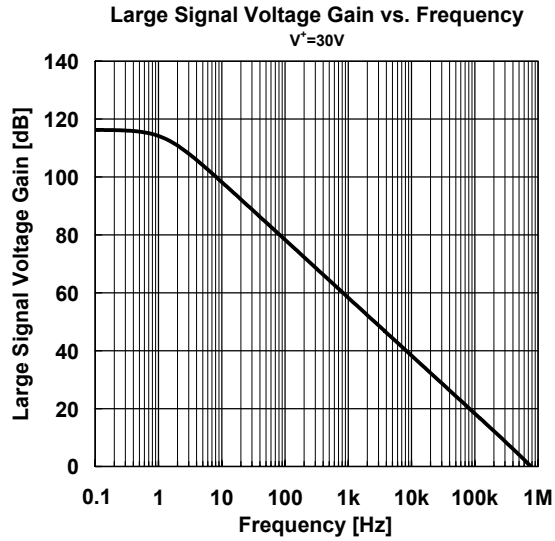


■ TYPICAL CHARACTERISTICS





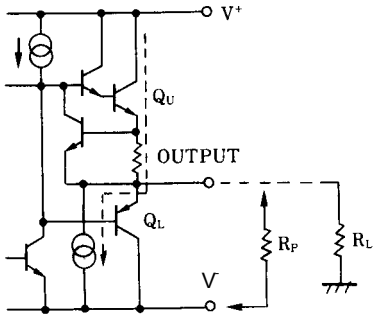




■ APPLICATION

Improvement of Cross-over Distortion

Equivalent circuit at the output stage

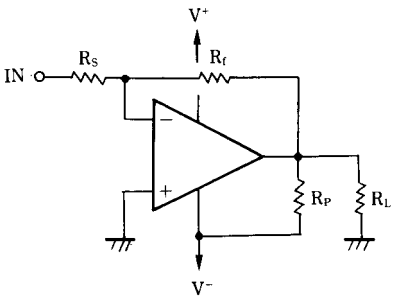


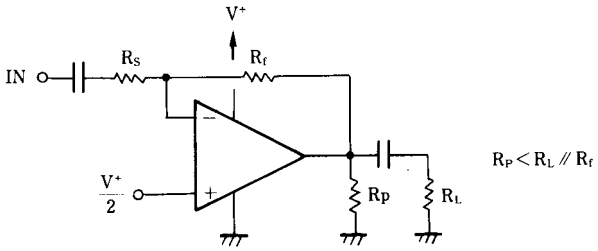
NJM2904C,in its static state (No in and output condition) when design,Q_U being biassed by constant current (break down beam) yet,Q_L stays OFF.

While using with both power source mode,the cross-over distortion might occur instantly when Q_L ON.

There might be cases when application for amplifier of audio signals,not only distortion but also the apparent frequency bandwidth being narrowed remarkably.

It is adjustable especially when using both power source mode,constantly to use with higher current on Q_U than the load current (including feedback current),and then connect the pull-down resister R_P at the part between output and V- pins.

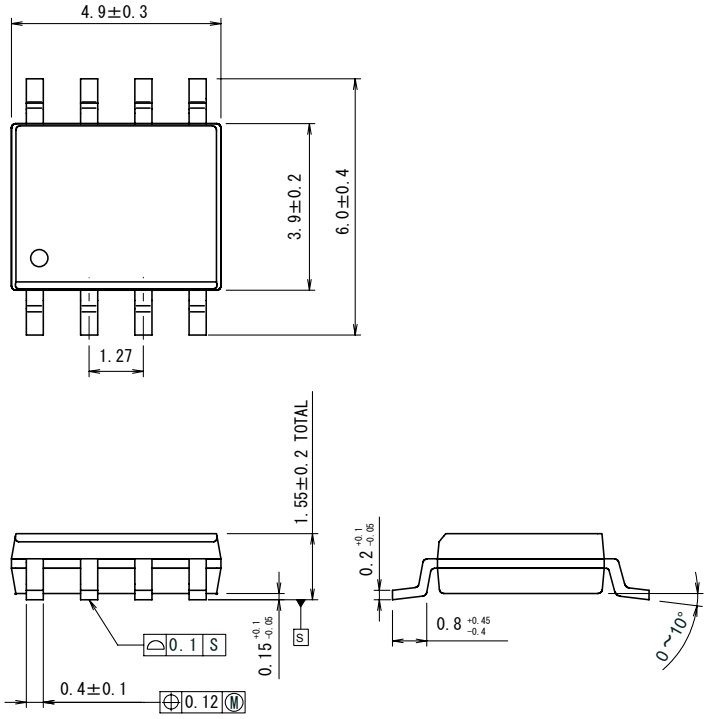




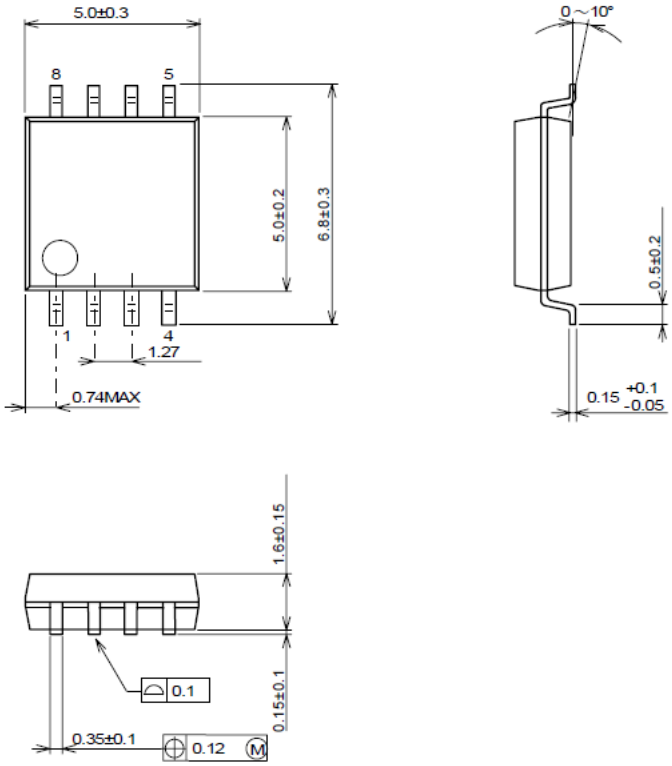
$R_P < R_L // R_f$

■PACKAGE OUTLINE UNIT : mm

SOP8



DMP8



■PACKAGE OUTLINE UNIT : mm

MSOP8 (TVSP8)*

*MEET JEDEC MO-187-DA / THIN TYPE