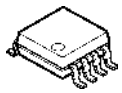
SINGLE-SUPPLY DUAL OPERATIONAL AMPLIFIER

■ FEATURES

- Single Supply Operation
- Supply Voltage +3V to +40V
- Low Operating Current 0.7mA typ.
- Slew Rate 0.5V/μs typ.
- Bipolar Technology
- Operating Temperature Ta= -40ºC to +125ºC
- Package Outline MSOP8 (VSP8) MEET JEDEC MO-187-DA

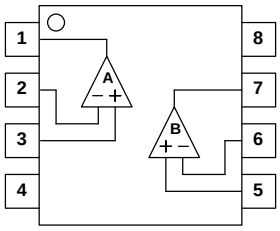
■ PACKAGE OUTLINE



NJM2904R-Z2
(MSOP8 (VSP8))

■ PIN CONFIGURATION

(Top View)

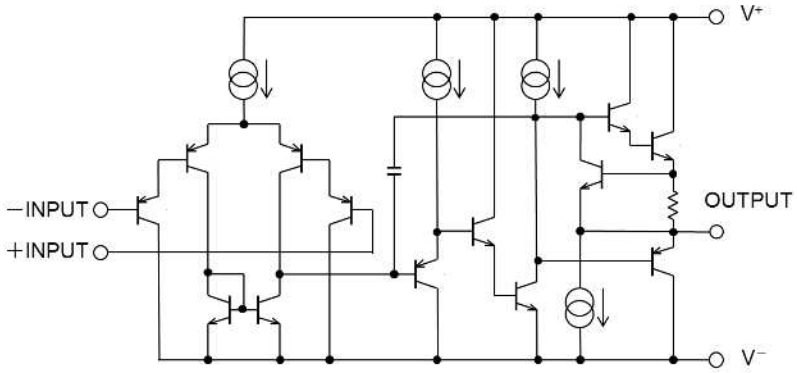


NJM2904R-Z2

PIN FUNCTION

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

■ EQUIVALENT CIRCUIT (1/2 Shown)



■ ABSOLUTE MAXIMUM RATINGS

(Ta=25˚C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	$V^+(V^+/V^-)$	40 (or ±20)	V
Differential Input Voltage (Note2)	V_{ID}	40	V
Input Voltage (Note3)	V_{IN}	V^--0.3 to V^-+40	V
Output Terminal Input Voltage	V_O	V^--0.3 to V^++0.3	V
Power Dissipation (Note4)	P_D	495	mW
Operating Temperature Range	T_{opr}	-40 to +125	˚C
Storage Temperature Range	T_{stg}	-50 to +150	˚C

Note1: Continuous short-circuits from output to GND is guaranteed only when $V^+ \leq 15V$.

Note2: Differential voltage is the voltage difference between +INPUT and -INPUT.

Note3: 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.

Note4: EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 2layers, FR-4) mounting

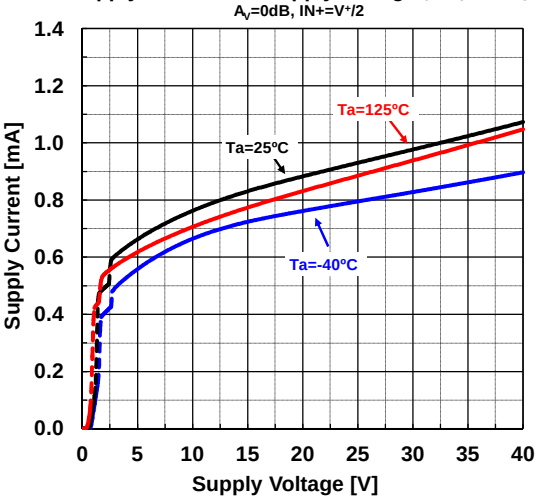
■ ELECTRICAL CHARACTERISTICS

(V^+=5V, Ta=25˚C, unless otherwise noted.)

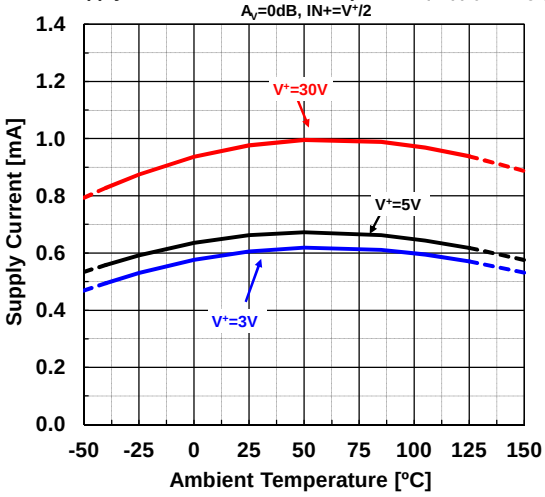
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Offset Voltage	V_{IO}	R_S=50Ω	-	2	4	mV
		R_S=50Ω, Ta=-40 ºC to +125 ºC	-	-	4	
Input Offset Voltage Drift	$\Delta V_{IO}/\Delta T$	Ta=-40 ºC to +125 ºC	-	1	-	µV/ºC
Input Offset Current	I_{IO}		-	5	50	nA
		Ta=-40 ºC to +125 ºC	-	-	50	
Input Bias Current	I_B		-	25	100	nA
		Ta=-40 ºC to +125 ºC	-	-	100	
Open-Loop Voltage Gain	A_V	R_L≥2kΩ to V^+/2	70	100	-	dB
		R_L≥2kΩ to V^+/2, Ta=-40 ºC to +125 ºC	70	-	-	
High-level Output Voltage	V_{OH}	R_L=2kΩ to 0V	3.5	-	-	V
		R_L=2kΩ to 0V, Ta=-40 ºC to +125 ºC	3.0	-	-	
Low-level Output Voltage	V_{OL}	R_L=2kΩ to 0V	-	-	0.05	V
		R_L=2kΩ to 0V, Ta=-40 ºC to +125 ºC	-	-	0.05	
Common Mode Input Voltage Range	V_{ICM}	CMR≥65dB	0	-	3.5	V
		CMR≥65dB, Ta=-40 ºC to +125 ºC	0	-	3.0	
Common Mode Rejection Ratio	CMR	V_{ICM}=0V to 3.5V	65	85	-	dB
		V_{ICM}=0V to 3.0V, Ta=-40 ºC to +125 ºC	65	-	-	
Supply Voltage Rejection Ratio	SVR	V^+=3.0V to 40V	65	100	-	dB
		V^+=3.0V to 40V, Ta= -40 ˚C to +125 ˚C	65	-	-	
Output Source Current	I_{SOURCE}	V_{IN}^+=1V, V_{IN}^-=0V	20	30	-	mA
		V_{IN}^+=1V, V_{IN}^-=0V, Ta= -40 ˚C to +125 ˚C	10	-	-	
Output Sink Current	I_{SINK}	V_{IN}^+=0V, V_{IN}^-=1V	8	20	-	mA
		V_{IN}^+=0V, V_{IN}^-=1V, Ta= -40 ˚C to +125 ˚C	5	-	-	
Supply Current (all amplifiers)	I_{SUPPLY}	No signal	-	0.7	1.2	mA
		No signal, Ta=-40 ºC to +125 ºC	-	-	2.0	
Channel Separation	CS	f=1k to 20kHz,Input Referred	-	120	-	dB
Slew Rate	SR	V^+/V^-=±15V	-	0.5	-	V/µs
Gain Bandwidth Product	GBW	V^+/V^-=±15V	-	0.6	-	MHz

■ TYPICAL CHARACTERISTICS

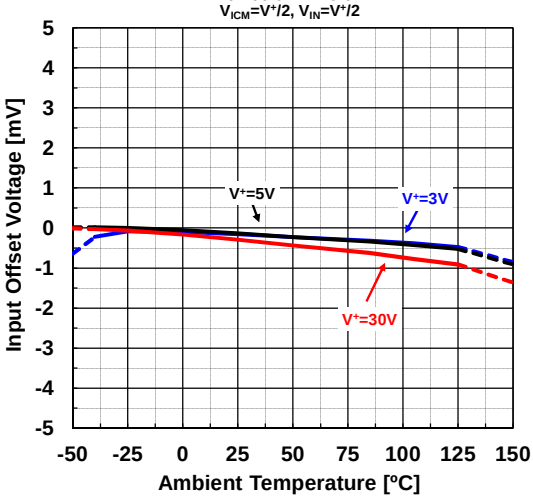
Supply Current vs. Supply Voltage (Temperature)
A_V=0dB, IN+=V+/2



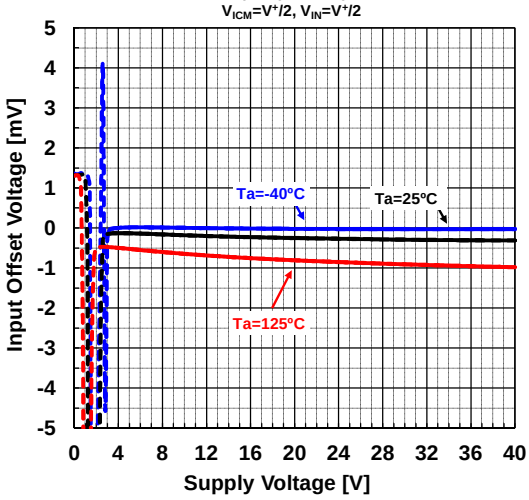
Supply Current vs. Ambient Temperature(Supply Voltage)
A_V=0dB, IN+=V+/2



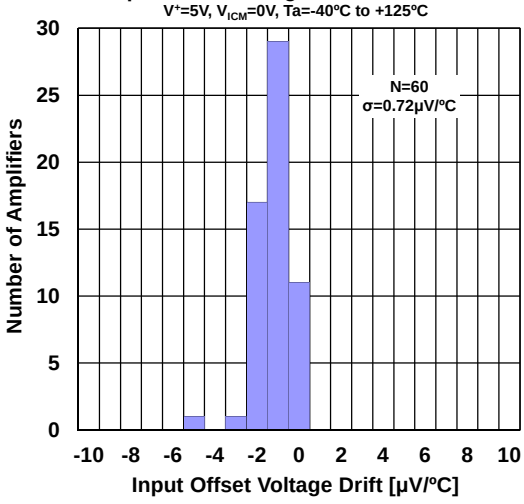
Input Offset Voltage vs. Ambient Temperature
(Supply Voltage)
V_{ICM}=V+/2, V_{IN}=V+/2



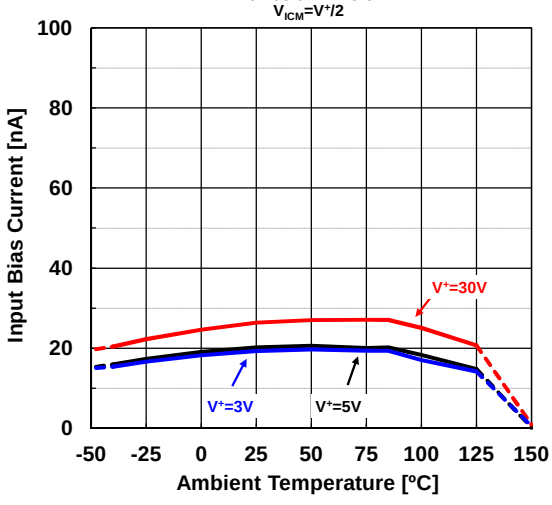
Input Offset Voltage vs. Supply Voltage
(Temperature)
V_{ICM}=V+/2, V_{IN}=V+/2



Input Offset Voltage Drift Distribution
V+=5V, V_{ICM}=0V, Ta=-40°C to +125°C

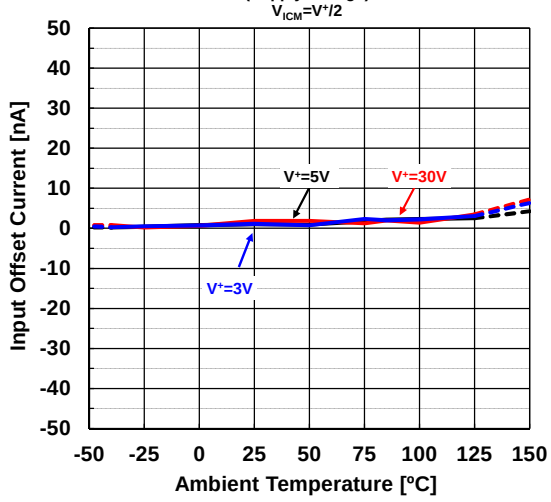


Input Bias Current vs. Ambient Temperature
(Supply Voltage)
V_{ICM}=V+/2

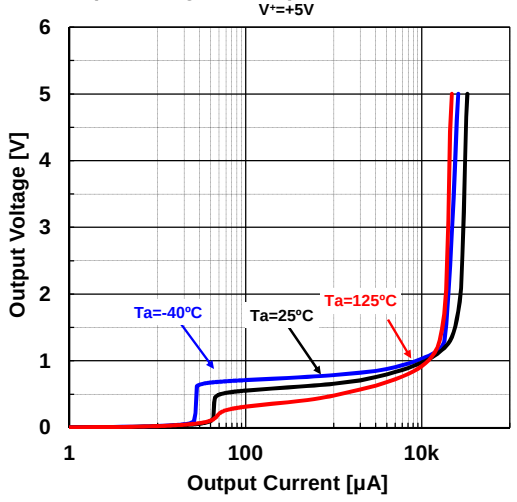


■ TYPICAL CHARACTERISTICS

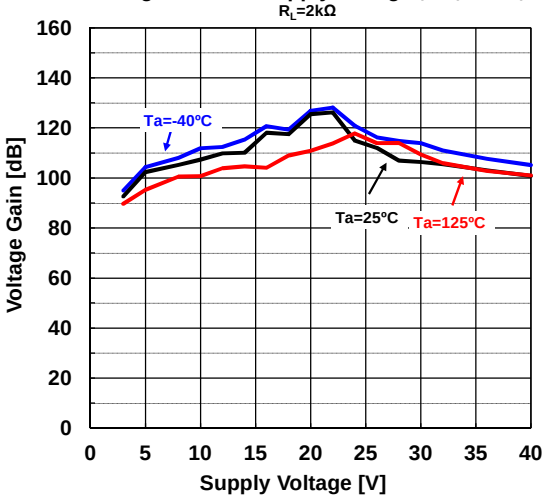
Input Offset Current vs. Ambient Temperature
(Supply Voltage)
$V_{ICM}=V^+/2$



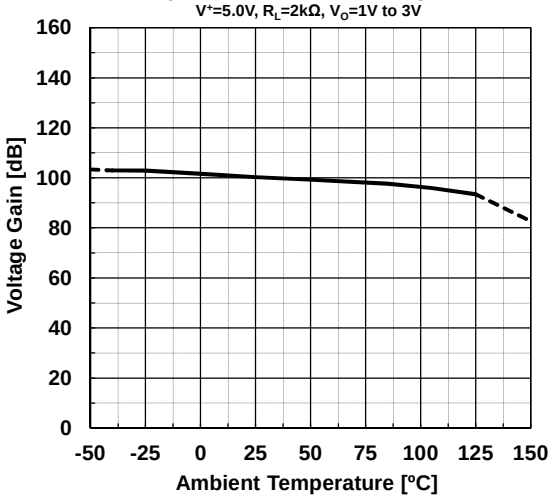
Output Voltage vs. Output Current (Temperature)
$V^+=+5V$



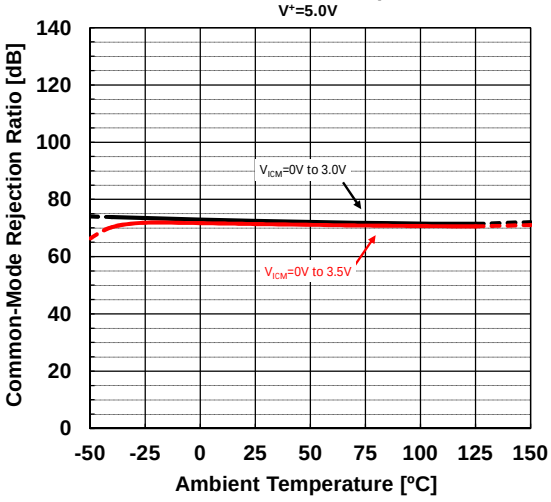
Voltage Gain vs. Supply Voltage (Temperature)
$R_L=2k\Omega$



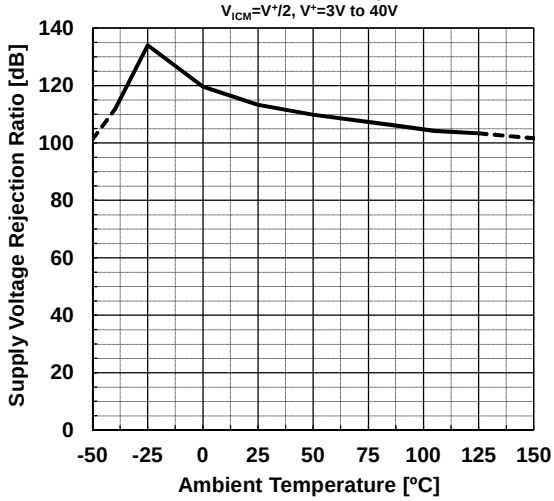
Voltage Gain vs. Ambient Temperature
$V^+=5.0V$, $R_L=2k\Omega$, $V_O=1V$ to $3V$



CMR vs. Ambient Temperature
$V^+=5.0V$

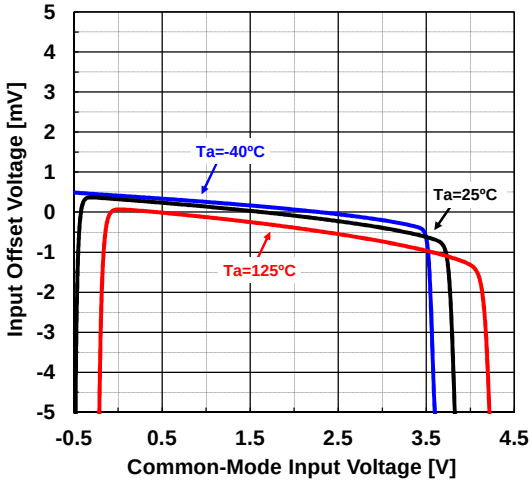


SVR vs. Ambient Temperature
$V_{ICM}=V^+/2$, $V^+=3V$ to $40V$

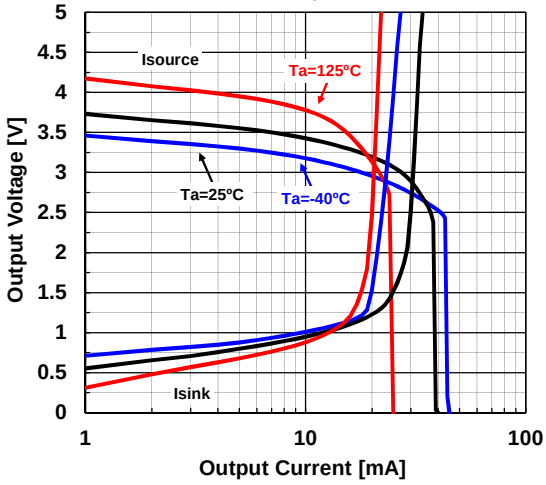


■ TYPICAL CHARACTERISTICS

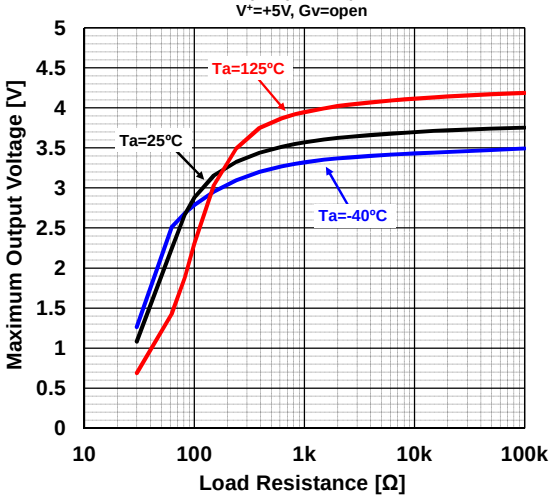
Input Offset Voltage vs. Common-Mode Input Voltage (Temperature)
V+=5V



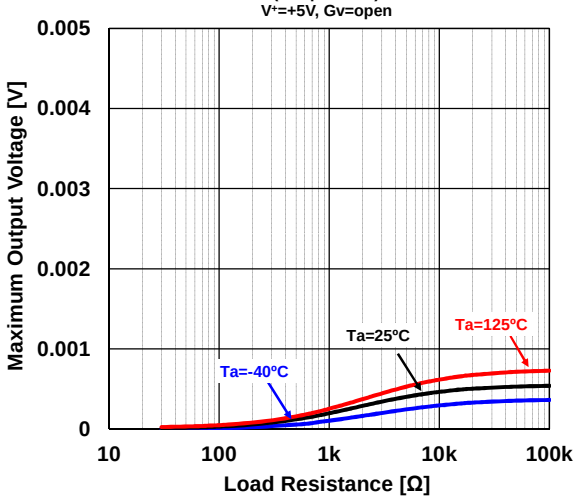
Output Voltage vs. Output Current (Temperature)
V+=+5V



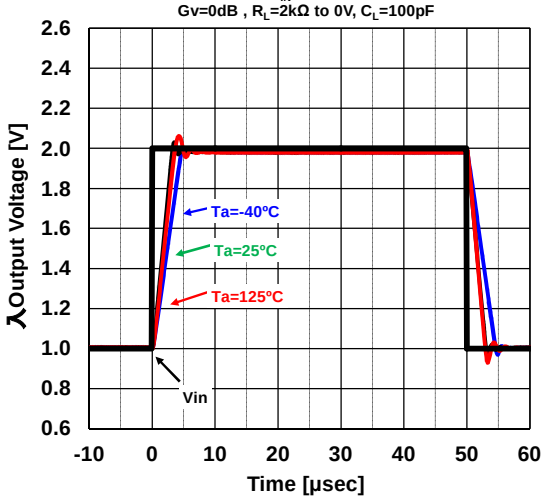
Maximum Output Voltage vs. Load Resistance (Temperature)
V+=+5V, Gv=open



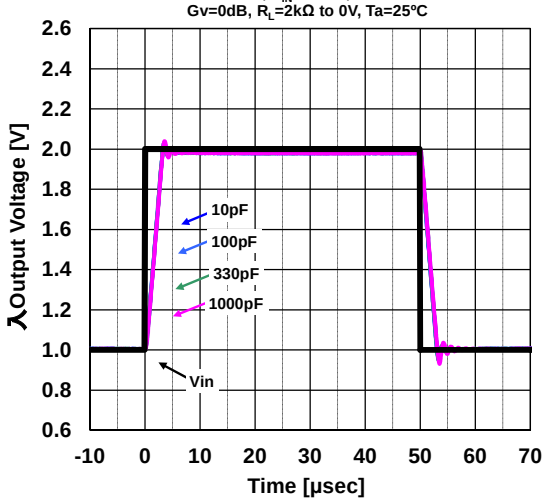
Maximum Output Voltage vs. Load Resistance (Temperature)
V+=+5V, Gv=open



Pulse Response (Temperature)
V+=+15V, V_{IN}=1VP-P, f=10kHz
Gv=0dB , R_L=2kΩ to 0V, C_L=100pF



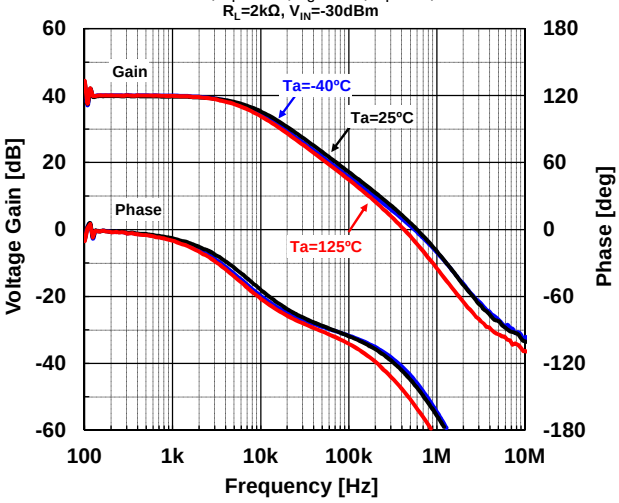
Pulse Response (Load Capacitance)
V+=+15V, V_{IN}=1VP-P, f=10kHz
Gv=0dB, R_L=2kΩ to 0V, Ta=25°C



■ TYPICAL CHARACTERISTICS

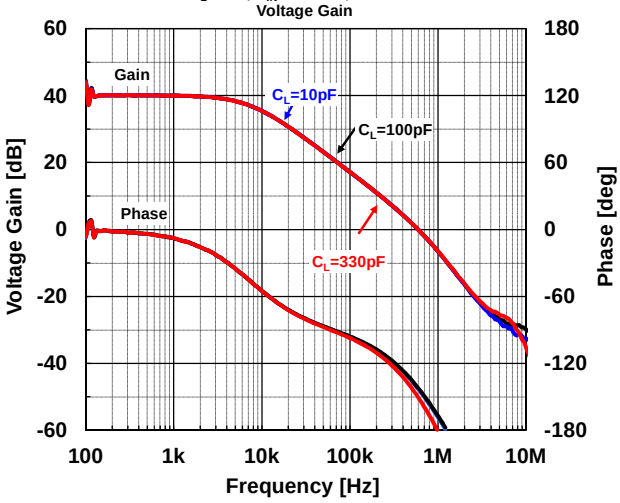
Voltage Gain vs. Frequency (Temperature)

V^+=5V, R_F=10kΩ, R_S=100Ω, R_T=50Ω,
R_L=2kΩ, V_{IN}=-30dBm



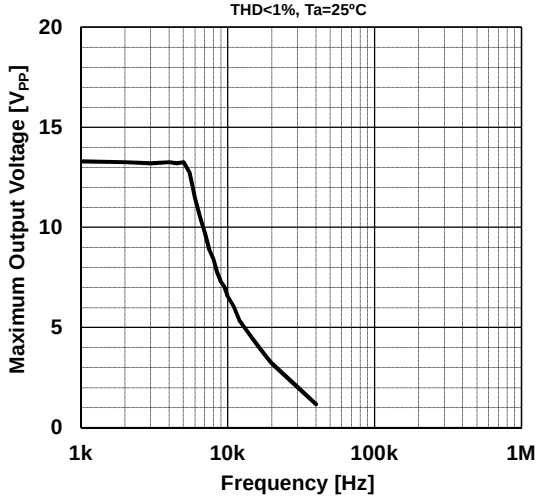
Voltage Gain vs. Frequency (Load Capacitance)

V^+=5V, R_F=10kΩ, R_S=100Ω, R_T=50Ω,
R_L=2kΩ, V_{IN}=-30dBm, Ta=25°C
Voltage Gain



Maximum Output Voltage Swing vs. Frequency

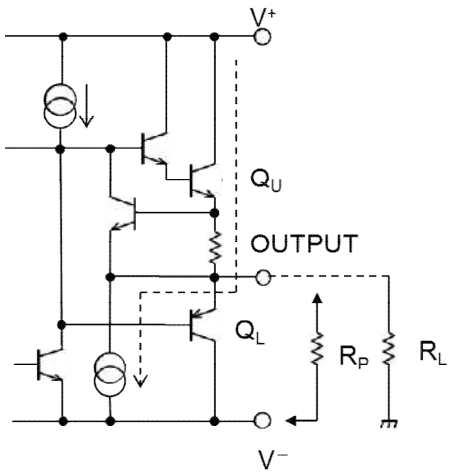
V^+=15V, VIN+=7V, Ci=1uF, Ri=1kΩ, R_F=100kΩ
THD<1%, Ta=25°C



■ APPLICATION

Improvement of Cross-over Distortion

Equivalent circuit at the output stage

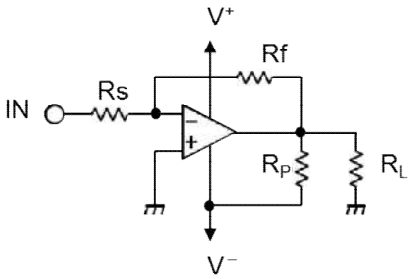


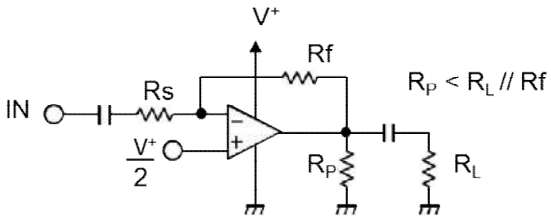
NJM2904, in its static state (No in and output condition) when design, Q_U being biassed by constant current (break down beam) yet,Q_L stays OFF.

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.





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