Ordering number : EN494G

SANYO Semiconductors
DATA SHEET

LA3160 — Monolithic Linear IC For Car Stereo 2-Channel Preamplifier

Overview

The LA3160 is a 2-channel preamplifier for car stereo.

Features

- Two preamplifiers on chip.
- Fewer peripheral parts.
- Low noise.
- 8-pin SIP package facilitating easy mounting.

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		18	V
Allowable power dissipation	Pd max		200	mW
Operating temperature	Topr		-20 to +75	°C
Storage temperature	Tstg		-40 to +125	°C

Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC}		9	V
Load resistance	R_L		10	kΩ

SANYO Semiconductor Co., Ltd.
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

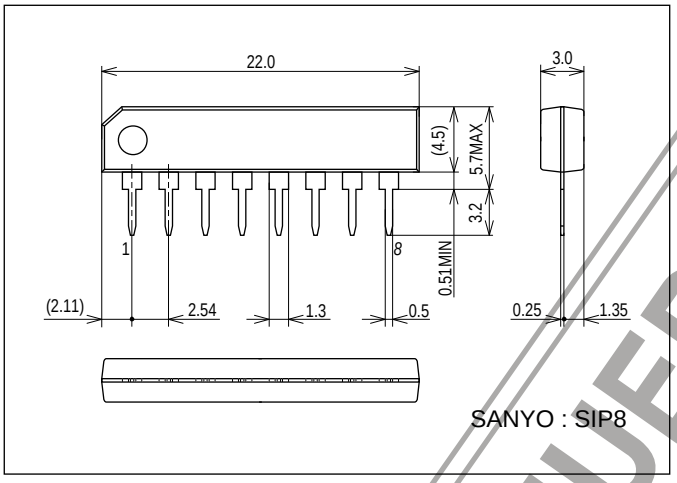
Electrical Characteristics at Ta = 25°C, V_{CC} = 9V, R_L = 10kΩ, Rg = 600Ω, f = 1kHz, NAB

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current dissipation	I_{CC}			4	6	mA
Voltage gain	VG	Closed loop		35		dB
		Open loop, V_O = 0.77V	76	80		dB
Output voltage	V_O	THD = 1%	1.1	1.8		V
Total harmonic distortion	THD	V_O = 0.5V		0.1	0.3	%
Input resistance	r_i		70	100		kΩ
Equivalent input noise voltage	V_{NI}	Rg = 2.2kΩ		1.25	2.0	μV
Crosstalk	CT		-50	-65		dB

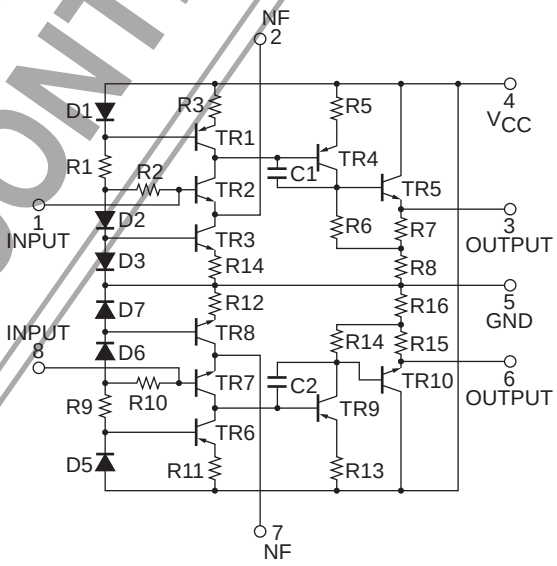
Package Dimensions

unit : mm (typ)

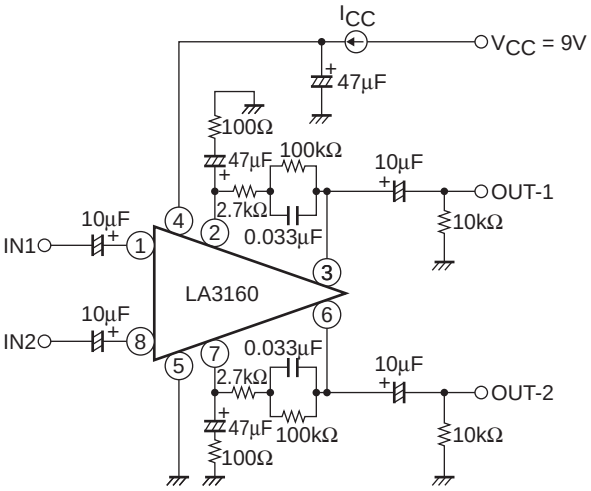
3016C



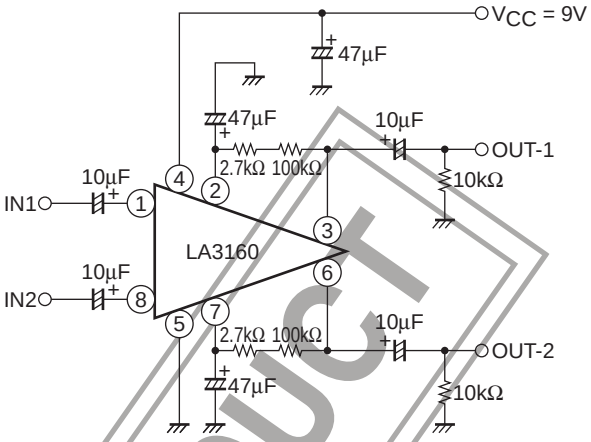
Equivalent Circuit



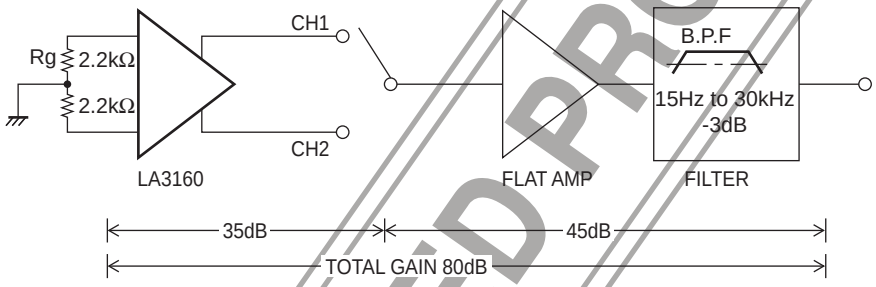
Test Circuit 1 : V_O, VG, THD, I_{CC}, r_i



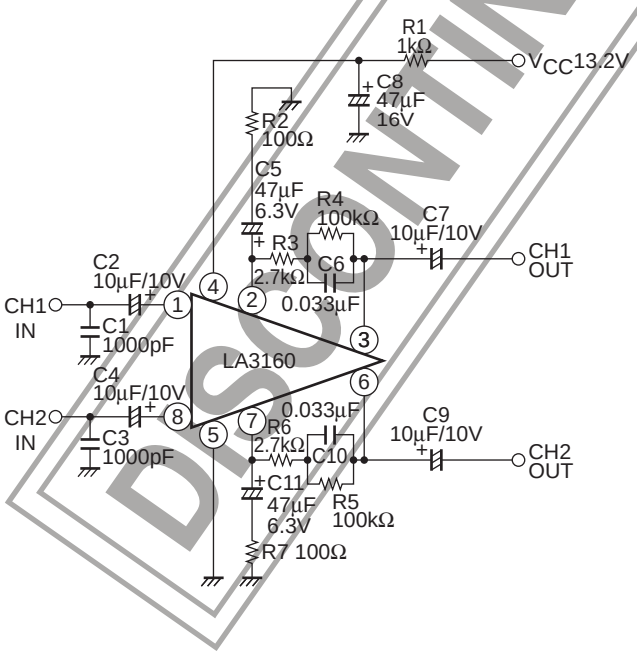
Test Circuit 2 : VG_O

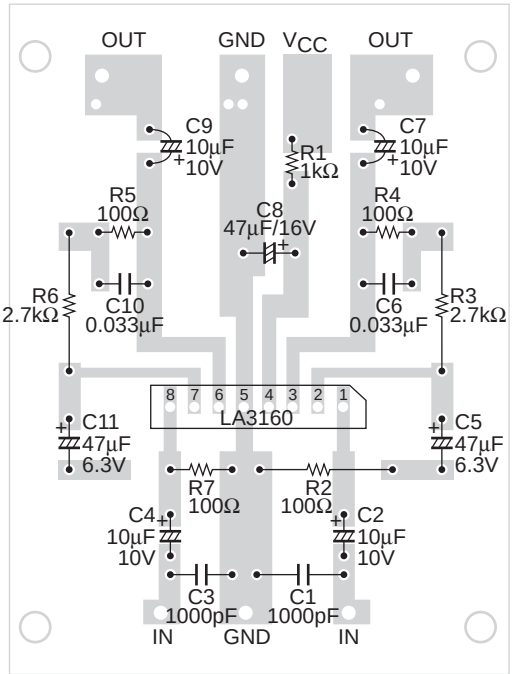


Test Circuit 3 : Noise



Application Circuit Example: Preamplifier for Car Stereo





Sample Printed Circuit Pattern
(Cu-foiled area, 67×50mm²)

Function of External Parts

C2, C4 are input coupling capacitors. In NAB equalizer amplifier, the gain at low frequencies is high and 1/f noise inside the IC is emphasized as output noise. Therefore, if the reactance of capacitor at low frequencies is increased, the dependence of 1/f noise on the signal source resistance causes the output noise voltage to deteriorate, and the value of reactance must be made small enough as compared with the signal source resistance. C2, C4 also influence the operation start time and the adequate value of these capacitors is 10μF. (Since C2, C4 of less than 4.7μF make the operation start time longer, use C2, C4 of 4.7μF or more).

C5, C11 are NF capacitors. The lower cut-off frequency depends on the value of these capacitors.

If the lower cut-off frequency is taken as f_L :

$$C5\ (C11) = 1/2\pi \times f_L \times R2\ (R7)$$

If the value of this capacitor is made larger, the operation start time of amplifier is more delayed. The adequate value of capacitor is 47μF.

The frequency characteristic of the equalizer amplifier depends on C6 and R4, R3 (C10 and R5, R6).

The time constants to obtain the standard NAB characteristic are as shown below.

Tepe speed	9.5cm/s	4.75cm/s
C6 (R3+R4)	3180μs	1590μs
R3 C6	90μs	120μs

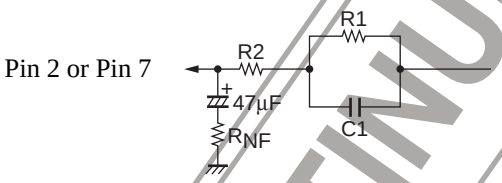
C8 is bias capacitor for the power line. C8 of 47μF is inserted at a point as close to the power supply pin (pin 4) as possible.

C1, C3 are for preventing radio interference in the strong electric field, interference attributable to engine noise, and blocking oscillation at the time of large amplitude operation. The adequate value of C1, C3 is approximately 1000pF.

C7, C9 are output coupling capacitors. The adequate value of C7, C9 is 10μF.

NAB element and determination of gain

Since the DC feedback is provided by R1, R2 of NAB element, which brings about DC output potential at pins 3, 6, it is impossible to change the value of R1, R2 of NAB element greatly. Therefore, when determining the gain, change R_{NF} with R1, R2, C1 (NAB element) kept constant.



(1) How to obtain R_{NF}

Impedance Z of NAB element is

$$Z = \frac{1}{1/R1 + j\omega C1} + R2$$

$$= (R1+R2)\left\{\frac{1+jWC1\{R1\,R2/(R1+R2)\}}{1+j\omega C1}\right\}$$

For a general negative feedback amplifier circuit, $A = Ao/(1+Ao\beta)$ applies, and $Z = A \cdot R_{NF}$ is obtained under conditions of Ao>>A, A>>1 ($\beta = R_{NF}/(R_{NF}+Z)$, Ao = open-loop gain, A = feedback gain.

Therefore, we can use an approximation of $R_{NF} = Z/A$.

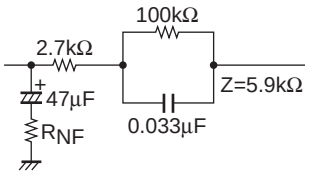
A = (VG for 1kHz) times, (Set R1, R2 at approximately 100kΩ)

Each time constant of NAB characteristic.

	Tepe speed	9.5cm/s	4.75cm/s
T1	C1, R1	3180μs	1590μs
T2	C1 (R1//R2)	90μs	120μs

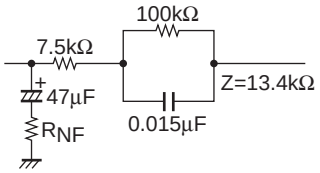
(2) Examples of NAB Constants

(a) Tape speed : 9.5cm/s for an 8-track recorder (Z, AG : at f = 1kHz)



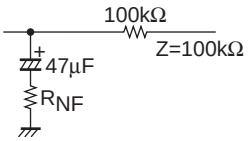
VG	30	35	40	dB
R_{NF}	180	100	56	Ω

(b) Tape speed : 4.75cm/s for a cassette tape recorder

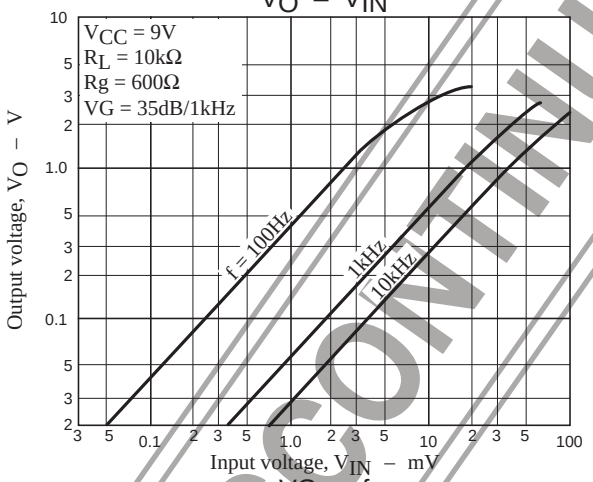


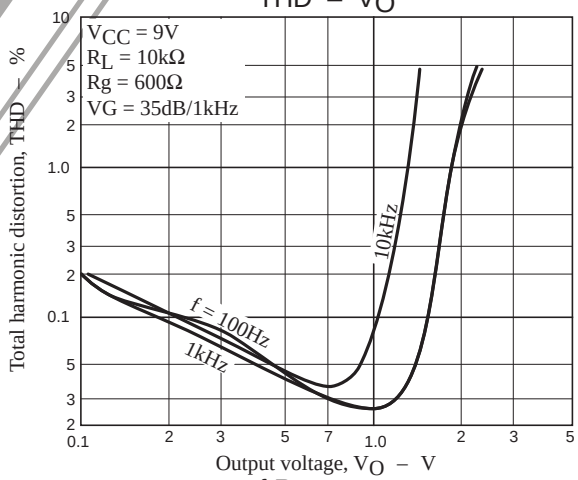
VG	30	35	40	dB
R_{NF}	440	240	130	Ω

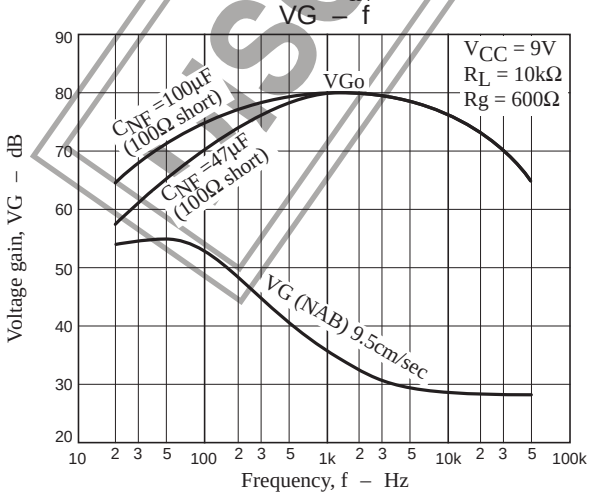
(c) Flat amplifier

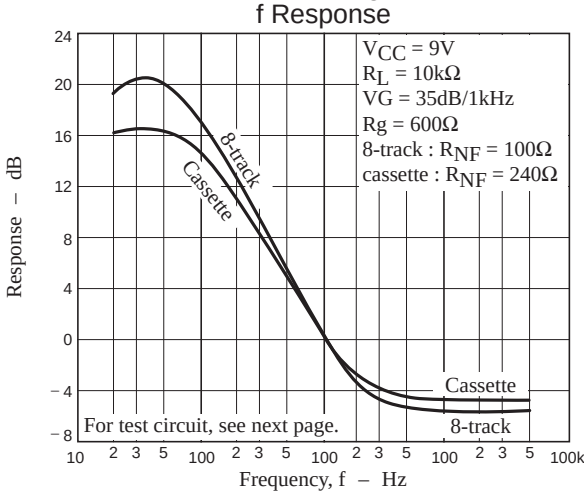


VG	30	35	40	dB
R_{NF}	3.2k	1.8k	1k	Ω

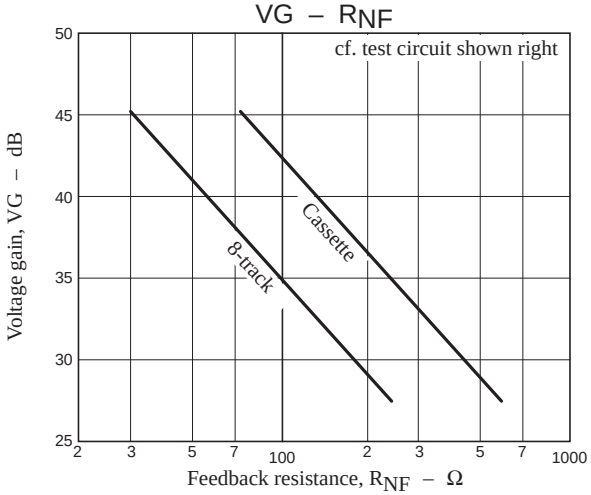




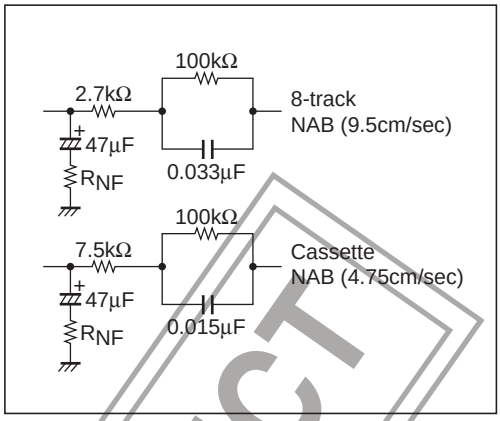




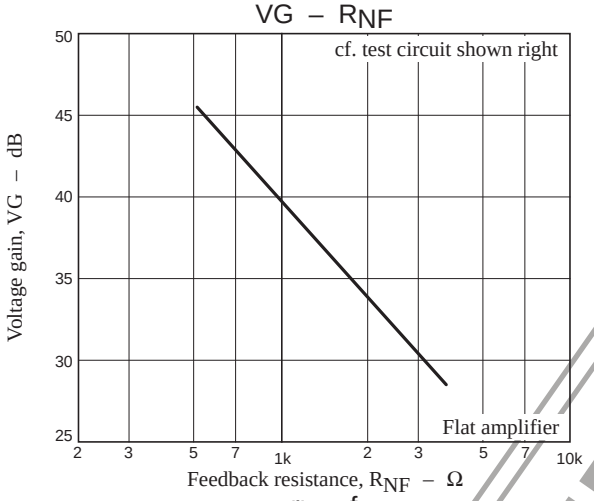
VG – R_{NF}



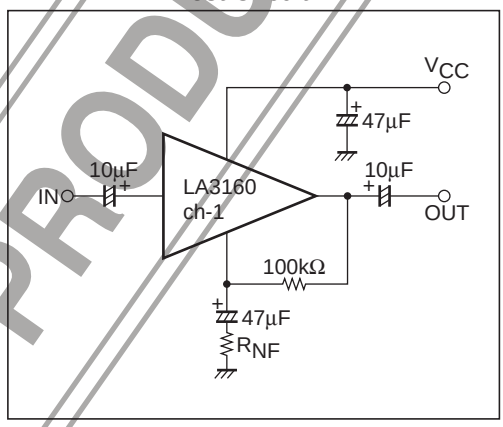
Test Circuit 1



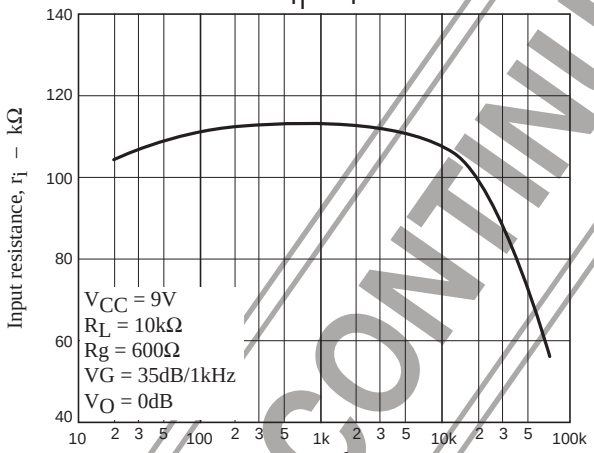
VG – R_{NF}



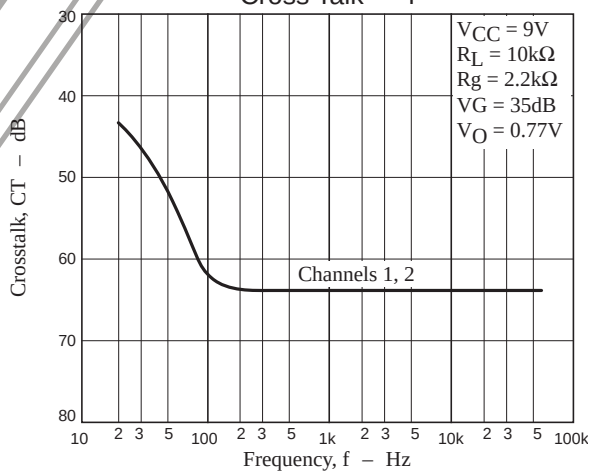
Test Circuit 2



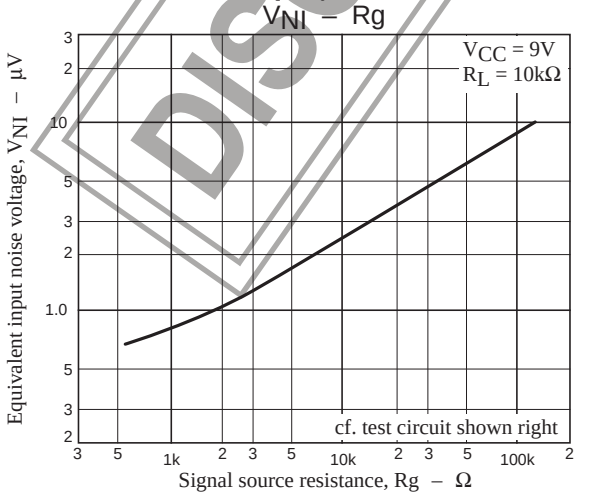
r_i – f



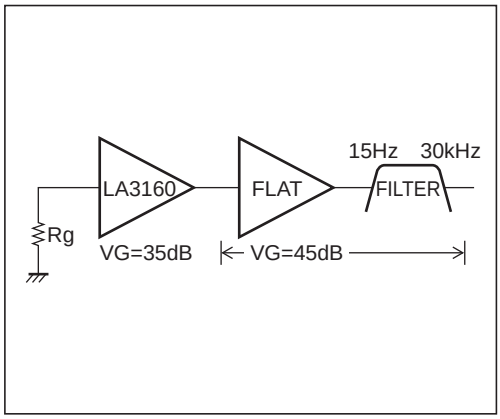
Cross Talk – f

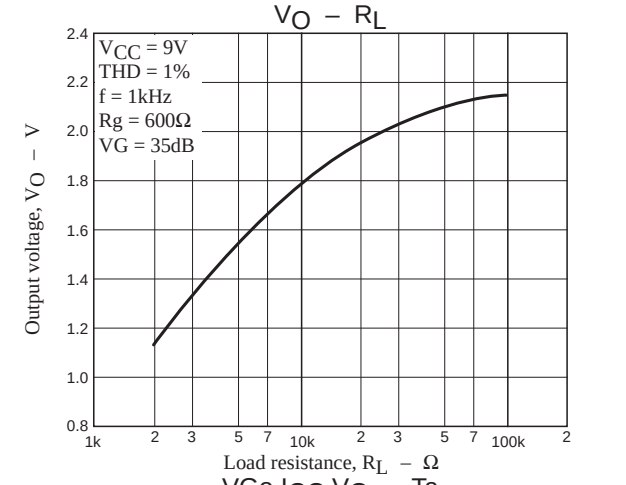


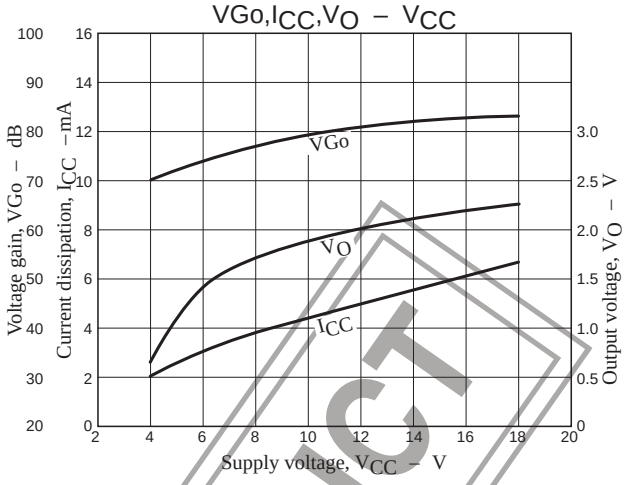
V_{NI} – Rg

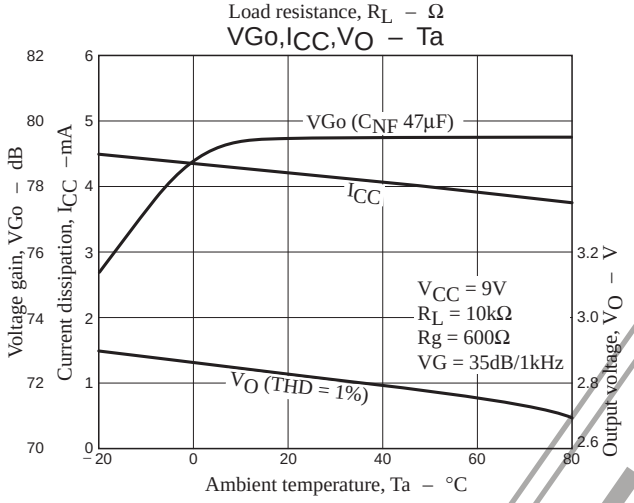


Test Circuit 3









Proper cares in using IC

1. Maximum Rating
   If the IC is used in the vicinity of the maximum rating, even a slight variation in conditions may cause the maximum rating to be exceeded, thereby leading to a breakdown. Allow an ample margin of variation for supply voltage, etc. and use the IC in the range where the maximum rating is not exceed.
2. Short between pins
   If the supply voltage is applied when the space between pins is shorted, a breakdown or deterioration may occur. When installing the IC on the board or applying the supply voltage, make sure that the space between pins is not shorted with solder, etc.
3. Breakdown of IC attributable to inverted insertion
   If the IC is inserted inversely and operated, the IC may suffer from something unusual, thereby leading to a breakdown or deterioration of the IC. When installing the IC on the board or operating the IC, check the marked surface of IC.

Proper cares to be taken for obtaining optimum operation of IC

- Set DC resistance of R1, R2 of NAB element at approximately 100kΩ.
- Determine the gain by changing RNF without chaging NAB constant (Refer to Examples of NAB constant.).
- Supply voltage characteristics are sufficiently considered, but supply voltage is recommended to be between 5V to 18V.

This catalog provides information as of April, 2008. Specifications and information herein are subject to change without notice.