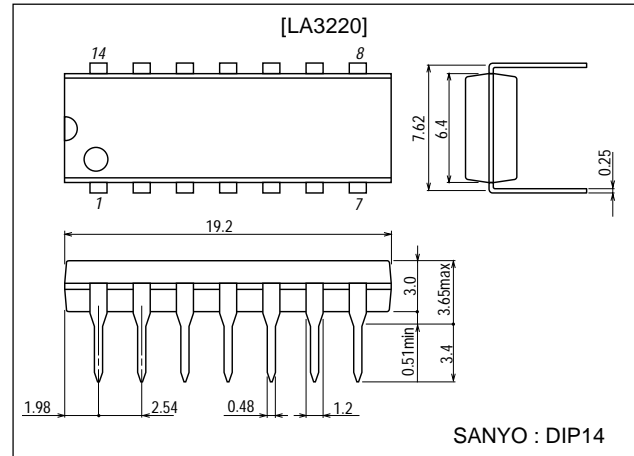


**LA3220****2-Channel Equalizer Amplifier with ALC****Features**

- Dual pre-amp with built-in ALC (pre-amp  $\times 2$  + ALC  $\times 2$ ).
- Due to high gain, recording amp can be formed separately (variable monitor possible).
- ALC and direct motor drive obtained through SEPP output stage.
- Good ALC response balance between channels.
- Good reduced voltage characteristic.
- Excellent channel separation.
- Quick stabilization during power supply input.

**Package Dimensions**

unit:mm

**3003A-DIP14****Specifications****Absolute Maximum Ratings** at  $T_a = 25^\circ\text{C}$ 

| Parameter                    | Symbol               | Conditions                  | Ratings     | Unit             |
|------------------------------|----------------------|-----------------------------|-------------|------------------|
| Maximum power supply voltage | $V_{CC \text{ max}}$ |                             | 14          | V                |
| Allowable power dissipation  | $P_d \text{ max}$    | $T_a \leq 40^\circ\text{C}$ | 600         | mW               |
| Operating temperature        | $T_{opr}$            |                             | -20 to +75  | $^\circ\text{C}$ |
| Storage temperature          | $T_{stg}$            |                             | -40 to +125 | $^\circ\text{C}$ |
| ALC Tr. allowable current    |                      |                             | 3.5         | mA               |

**Operating Conditions** at  $T_a = 25^\circ\text{C}$ 

| Parameter                        | Symbol   | Conditions | Ratings           | Unit     |
|----------------------------------|----------|------------|-------------------|----------|
| Recommended power supply voltage | $V_{CC}$ |            | 5 to 13           | V        |
| Load resistance                  | $R_L$    |            | not less than 680 | $\Omega$ |

**Operating Characteristics** at  $T_a = 25^\circ\text{C}$ ,  $V_{CC}=5\text{V}$ ,  $f=1\text{kHz}$ ,  $R_L=10\text{k}\Omega$  (PB),  $R_g=680\Omega$  (REC),

See specified Test Circuit.

| Parameter              | Symbol            | Conditions | Ratings |     |     | Unit |
|------------------------|-------------------|------------|---------|-----|-----|------|
|                        |                   |            | min     | typ | max |      |
| Quiescent current      | $I_{CCO}$         |            |         | 4.5 | 10  | mA   |
| Open voltage gain      | $V_{GO}$          |            |         | 85  |     | dB   |
| Voltage gain           | VG                | PB         |         | 40  |     | dB   |
|                        |                   | REC        |         | 58  |     | dB   |
| Maximum output voltage | $V_O \text{ max}$ | THD=1%, PB | 0.9     | 1.2 |     | V    |

Continued on next page.

■ Any and all SANYO products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your SANYO representative nearest you before using any SANYO products described or contained herein in such applications.

■ SANYO assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO products described or contained herein.

**SANYO Electric Co.,Ltd. Semiconductor Company**

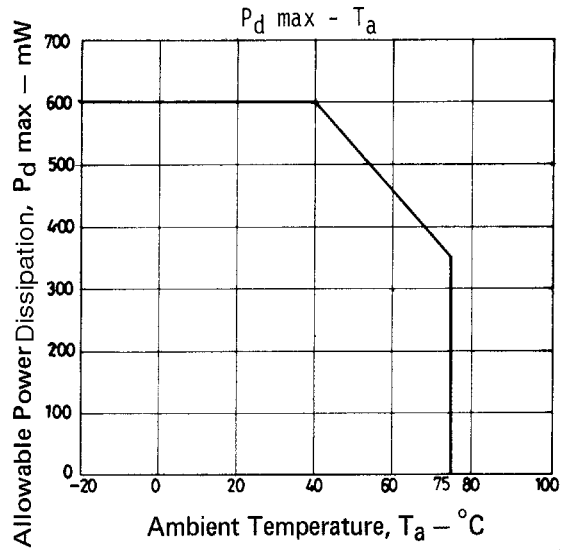
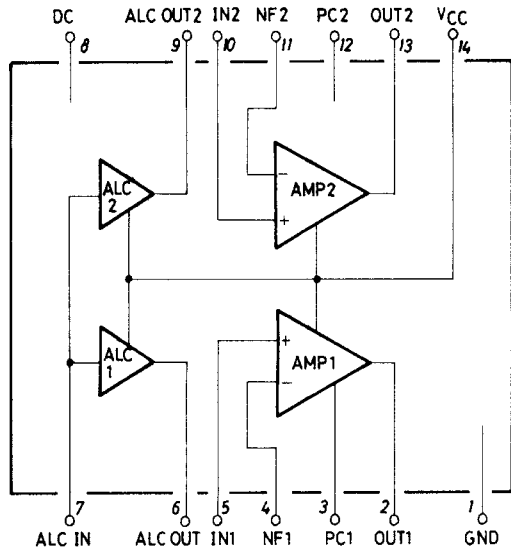
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

# LA3220

Continued from preceding page.

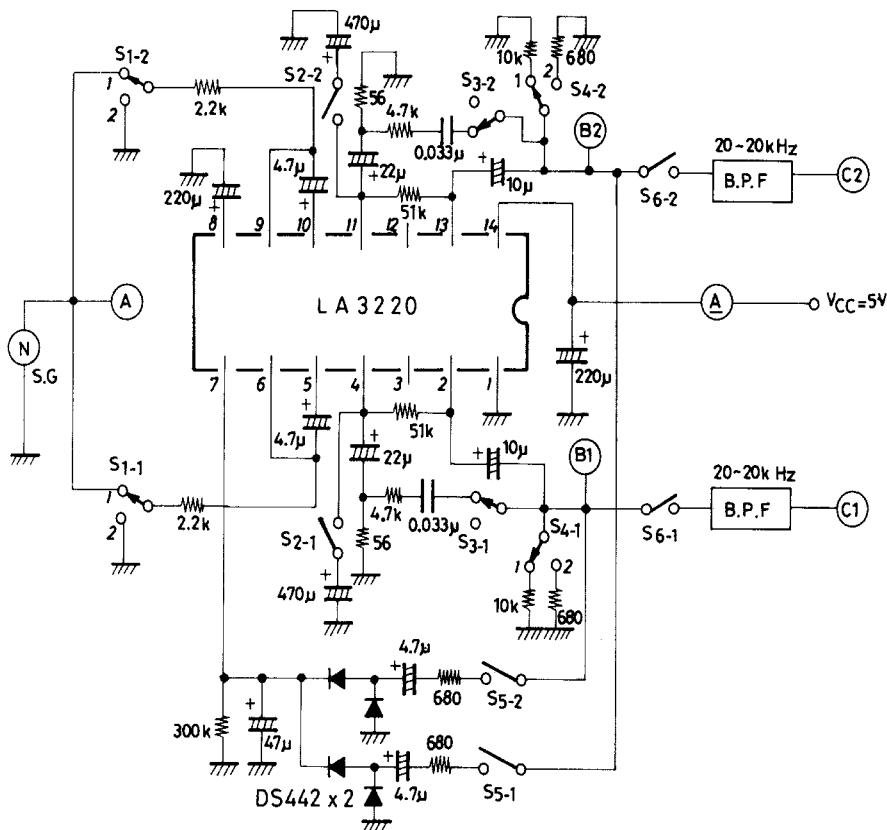
| Parameter                        | Symbol   | Conditions                                  | Ratings |     |     | Unit       |
|----------------------------------|----------|---|---------|-----|-----|------------|
|                                  |          |   | min     | typ | max |            |
| Total harmonic distortion        | THD      | $V_O=0.5V$ , PB                             |         | 0.1 | 1.0 | %          |
| Input resistance                 | $r_i$    |   | 21      | 30  |     | k $\Omega$ |
| Channel separation               | SEP      | $R_g=2.2k\Omega$ , $V_O=0dB$ , PB           | 40      | 50  |     | dB         |
| Noise voltage converted to input | $V_{NI}$ | $R_g=2.2k\Omega$ , B.P.F.=20Hz to 20kHz, PB |         | 1.0 | 2.0 | $\mu V$    |
| ALC width                        |          | $V_i=-60dBm$ , REC                          | 35      | 45  |     | dB         |
| ALC balance                      |          | $V_i=-20dBm$ , REC                          |         | 0   | 2.0 | dB         |
| ALC distortion                   |          | $V_i=-60dBm$ , REC                          |         | 0.5 | 2.0 | %          |

## Equivalent Circuit Block Diagram



## Test Circuit

Unit (resistance:  $\Omega$ , capacitance: F)



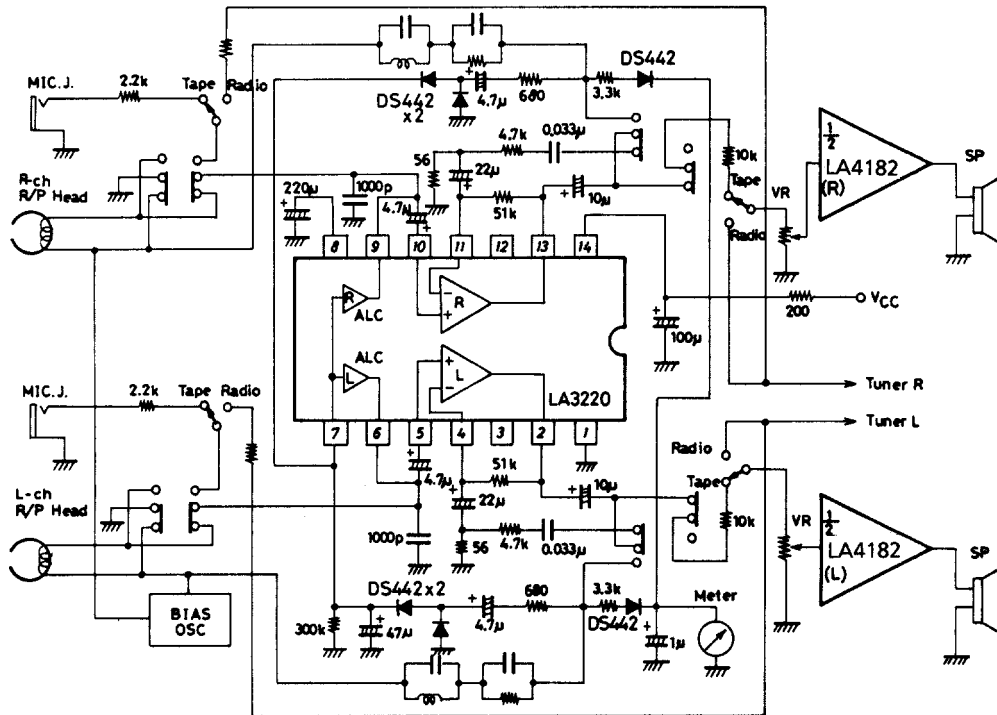
# LA3220

## Test Procedure

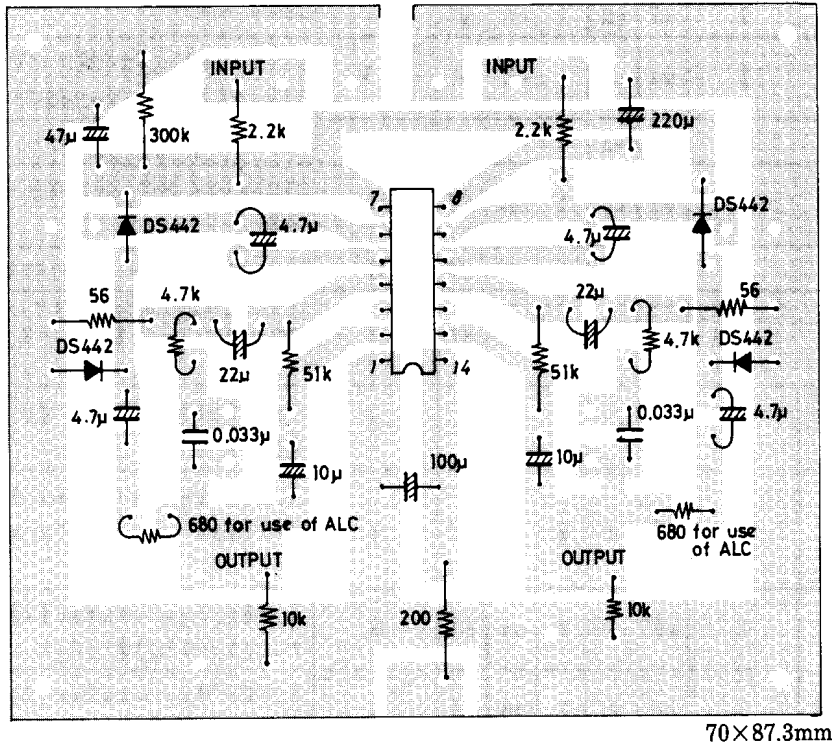
| Item               | S1                              | S2                         | S3  | S4 | S5  | S6  | Measurement location | Procedure   |
|--------------------|---------------------------------|----------------------------|-----|----|-----|-----|----------------------|---|
| I <sub>CCO</sub>   | 2                               | off                        | off | 1  | off | off | –                    | Read ammeter.   |
| V <sub>GO</sub>    | 1                               | on                         | off | 1  | off | off | A, B                 | Measure at V <sub>GO</sub> =20log V <sub>O</sub> /V <sub>I</sub> (dB) with input voltage at V <sub>I</sub> ; output voltage at V <sub>O</sub> . |
| VG                 | 1                               | off                        | on  | 1  | off | off | A, B                 | V <sub>G</sub> =20log V <sub>O</sub> /V <sub>I</sub> (dB)   |
| V <sub>O</sub> max | 1                               | off                        | on  | 1  | off | off | B                    | Measure output voltage V <sub>O</sub> at THD=1%.  |
| THD                | 1                               | off                        | on  | 1  | off | off | B                    | Measure distortion factor at V <sub>O</sub> =0.5V.  |
| CH sep             | S <sub>1-1</sub><br>1<br>2<br>2 | S <sub>1-2</sub><br>2<br>1 | off | on | 1   | off | B                    | Measure crosstalk of amp 1, 2 at output voltage V <sub>O</sub> =0dBm.   |
| V <sub>NI</sub>    | 2                               | off                        | on  | 1  | off | on  | C                    | Obtain output noise voltage in 1kHz gain equivalent when R <sub>G</sub> =2.2kΩ.   |
| ALC width          | 1                               | off                        | off | 2  | on  | off | B                    | Input voltage range from when input voltage V <sub>I</sub> =-60dBm until output voltage V <sub>O</sub> goes up 3dB.                             |
| ALC balance        | 1                               | off                        | off | 2  | on  | off | B                    | Output voltage V <sub>O</sub> level difference between amp 1, 2 when input voltage V <sub>I</sub> =-20dBm is applied.                           |
| ALC distortion     | 1                               | off                        | off | 2  | on  | off | B                    | Measure distortion factor when input voltage V <sub>I</sub> =-20dBm is applied.   |

## Sample Application Circuit : Variable Monitor System

Unit (resistance: Ω, capacitance: F)



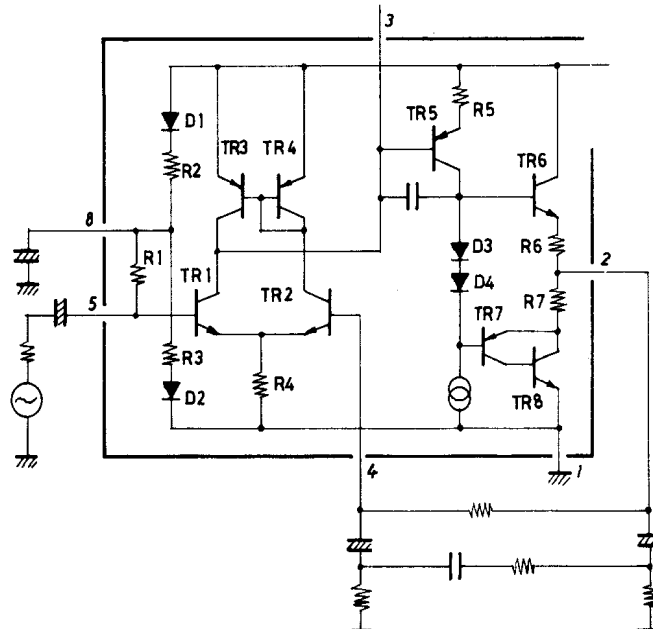
UNIT (resistance: Ω, capacitance: F)



Example of Print Pattern (copper foil side)

1. Circuit Construction

1) This is a dual pre-amp composed of AMP × 2, ACL × 2. Input is obtained from NPN differential TR1, TR2 ; and differential load uses active element TR3 to obtain high voltage gain. The output stage is push-pull system with drive for low load impedance, and can be directly connected to ALC circuit and meter circuit. Also, because the amp open loop gain is sufficiently high, it can be used for recording amp and variable monitor is possible. Input impedance is determined by built-in resistor R1, and is 30kΩ.



2) ALC Circuit

The ALC circuit is composed of TR1, TR2, and due to DC voltage applied to the 7 control terminals, allows variable impedance between TR1 collector and emitter and controls pre-amp input level.

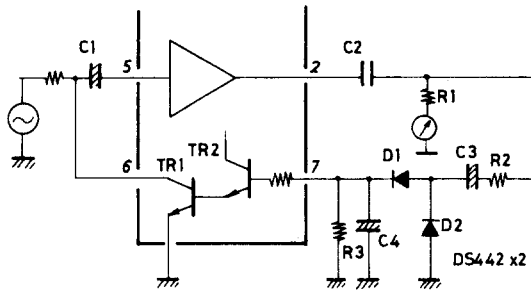
\* Attack Time and Recovery Time

Attack time is between when input signal is applied until ALC begins to operate. Rcover time is between just by R2, C3 time constant. Recovery time is between when input signal disappears to when amp level returns to the original level. Attack time can be adjusted by C4, R3 time constant.

continued on next page.

# LA3220

The rectification circuit, which obtains ALC control voltage, should be a voltage doubler with superior compression ratio. Also, for low voltage 6V sets, etc., a germanium diode is recommended for D1, D2.



Unit (resistance:  $\Omega$ , capacitance: F)

## 2. Closed loop gain VG (f=1kHz)

Closed loop voltage gain is gotten at (f=1kHz)  $VG \approx 20 \log Z1/Z3$

If  $Z1=7.2k\Omega$

$Z3=56\Omega$

$VG=20 \log 7.2 \times 10^3 / 56$  becomes=42dB.

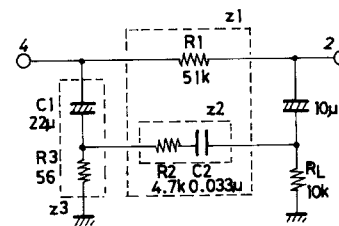
Therefore, equalizer response is determined by these constants.

So, playback amp gain is :

- $20 \log R1/R3$  in low frequency regions
- $20 \log Z2/Z3$  in high frequency regions

Recording amp gain is

$VG=20 \log R1/R3$



## 3. External constants

External constants are related to the operation starting time of the amp.

The operation starting time is designed to be within 0.2s, but in this case it is necessary that the differential TR1 and TR2 is the same in time constant. The condition is :

$C1 (R1/R2)=R5 \cdot C3$

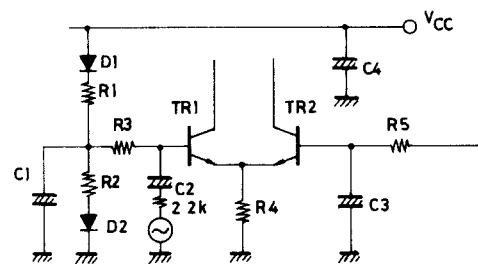
Example : If  $C1=220\mu$ ,  $R1/R2=5k\Omega$ ,  $R5=51k\Omega$

then  $C3$  is  $22\mu F$

- $C1$  is a decoupling capacitor, and its capacity changes the ripple rejection rate. (If capacity is large, ripple rejection rate is large.) It is also related to the amp operation starting time, and when  $R5$ ,  $C3$  time constant is large,  $C1$  must also be made large. The recommended value is  $220\mu F$ .
- $C2$  is an input capacitor, and more than  $4.7\mu F$  is recommended.
- $C3$  is an NF capacitor, and determines the low region cut-off frequency. If  $C3$  is increased, operation starting time lengthens.  $10\mu F$  is recommended. The recommended constants therefore are :

| R5 (R $\Omega$ )     | C1 (CD)     | C2 (IN)     | C3 (NF)    |
|----------------------|-------------|-------------|------------|
| 51k to 100k $\Omega$ | 220 $\mu F$ | 4.7 $\mu F$ | 22 $\mu F$ |
| 200k $\Omega$        | 330 $\mu F$ | 10 $\mu F$  | 10 $\mu F$ |

We do not recommended more than 200k $\Omega$  for  $R5$  which lengthens amp operation starting time.



## 4. Notes on Use

### 1) Oscillation

When the amp closed loop gain is lowered, oscillation will occur, so when using it with under 40dB gain, connect 10pF between pin 3 and pin 2, and  $0.033\mu F$  (mylar) +  $10\Omega$  to the load end. When closed loop gain is below  $VG=30dB$ , it should not be used.

### 2) Radio Interference Prevention

Connect about 1000pF between input pin (pin 5) and the ground.

### 3) Maximum Rating

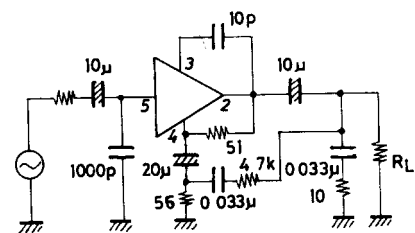
$V_{CC}$  max is  $V_{CC}=14V$ , and it should not go over this. The recommended power supply voltage is 5V to 13V.

### 4) Load Impedance

The total load impedance as seen from the output terminal should not be less than 680 $\Omega$ .

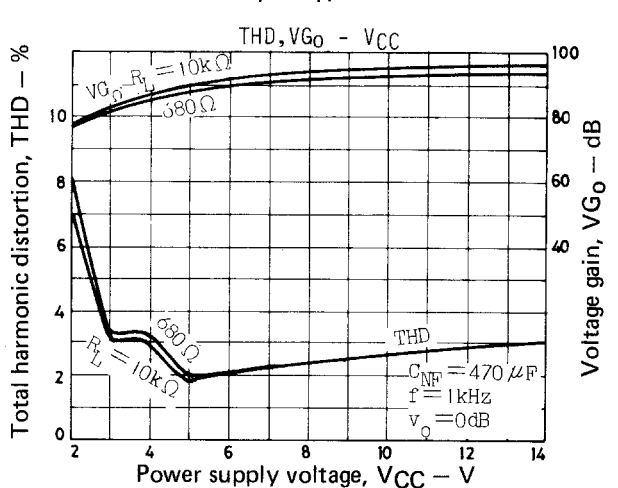
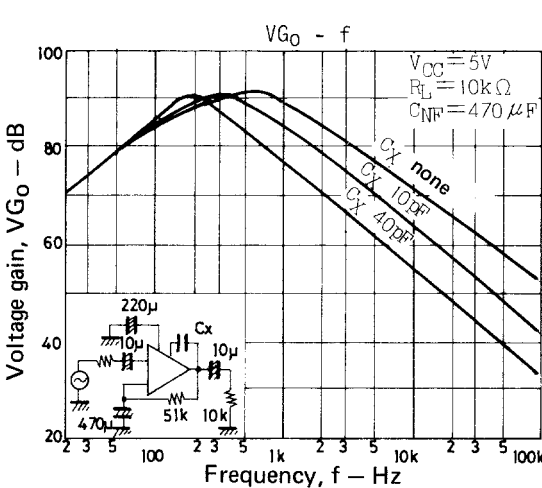
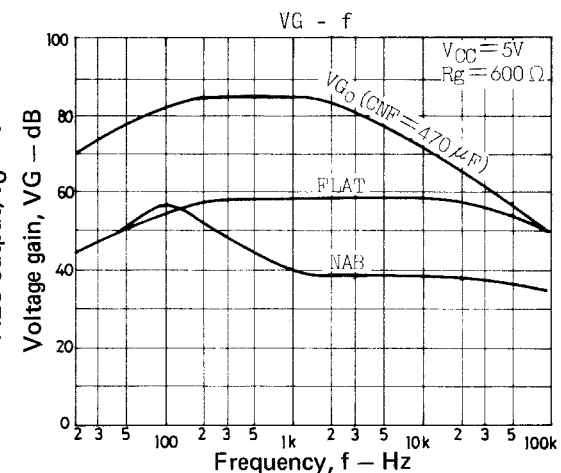
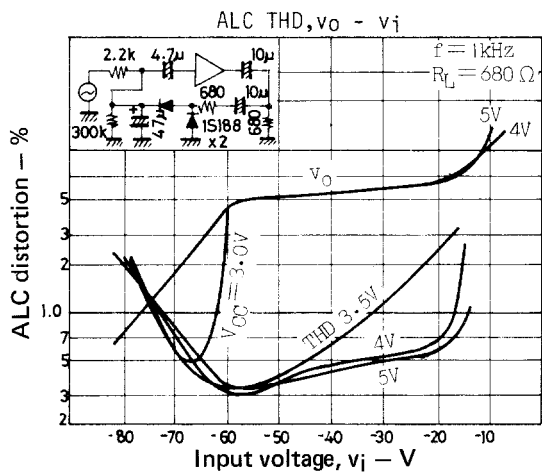
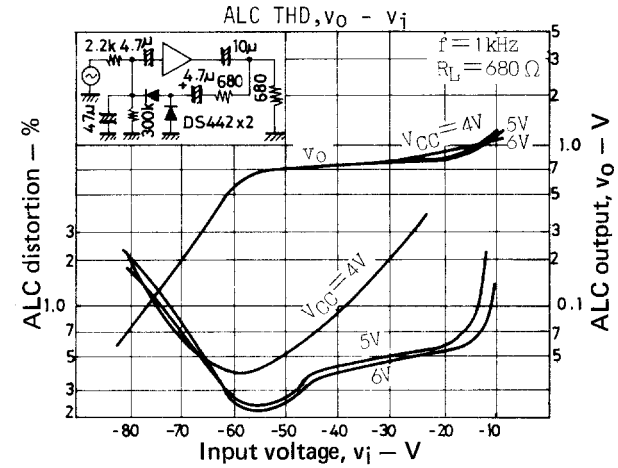
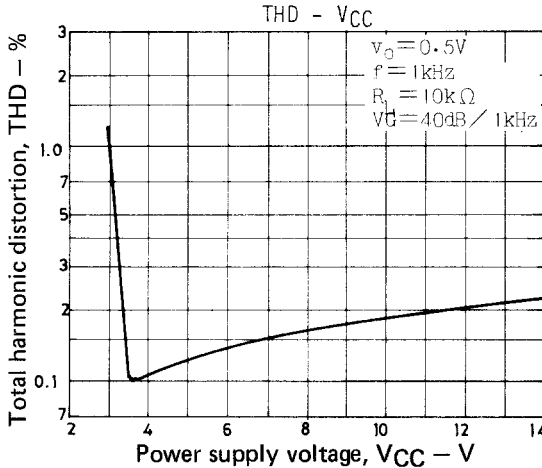
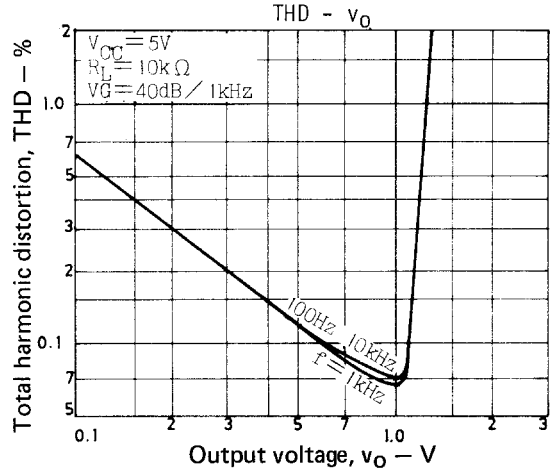
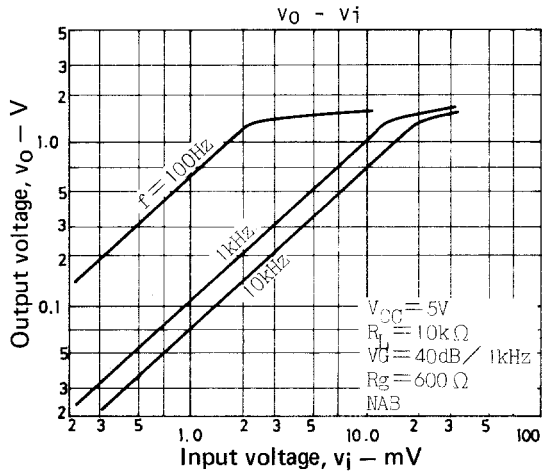
5) A short between pins will cause breakdown or deterioration.

6) A load short will cause breakdown or deterioration.

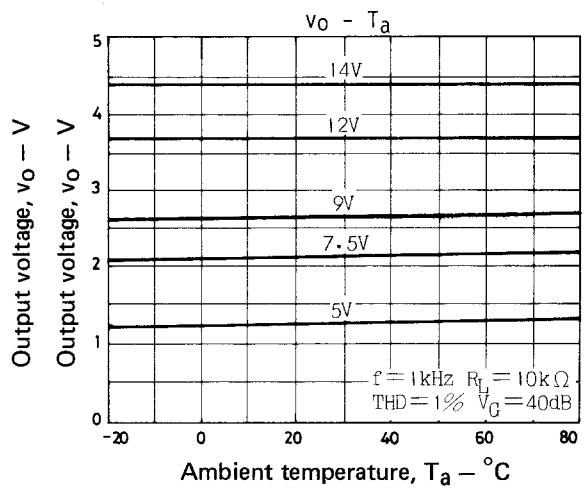
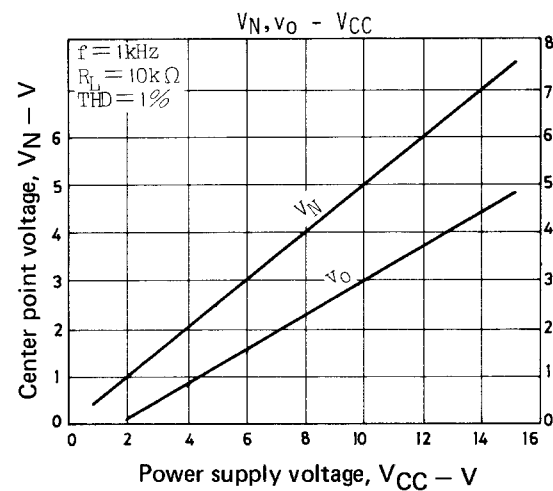
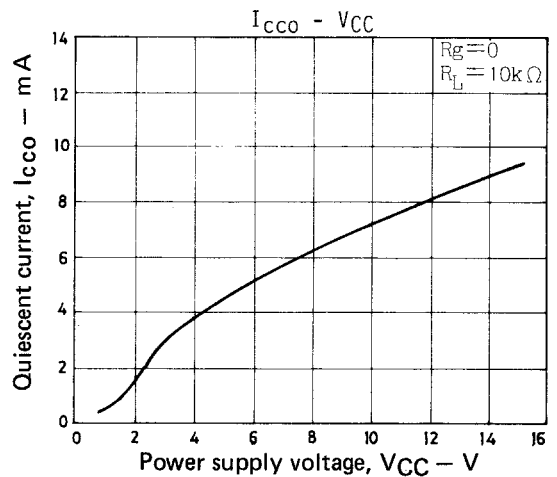
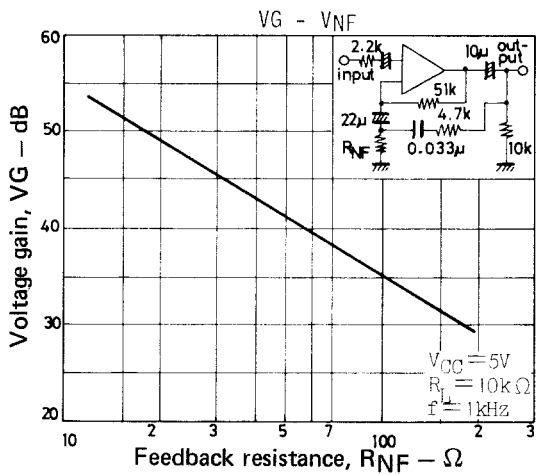
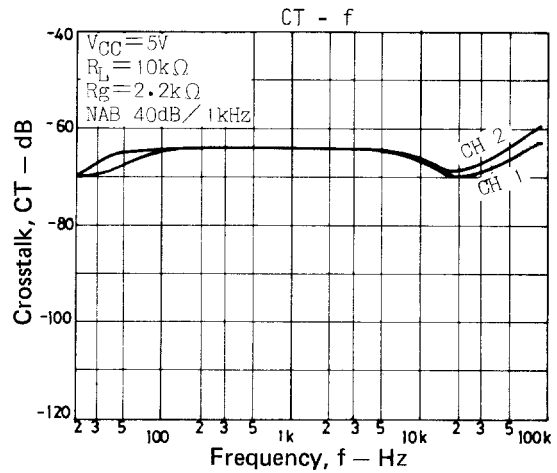
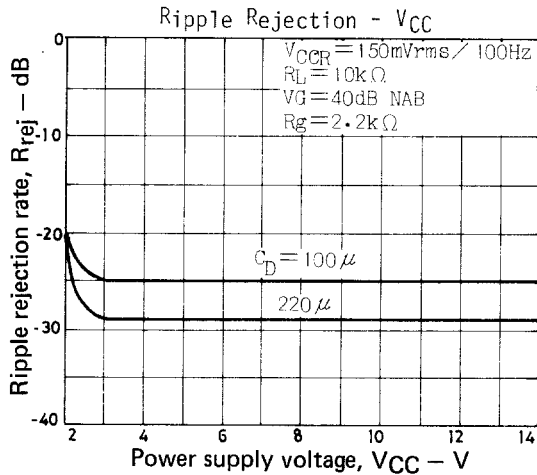
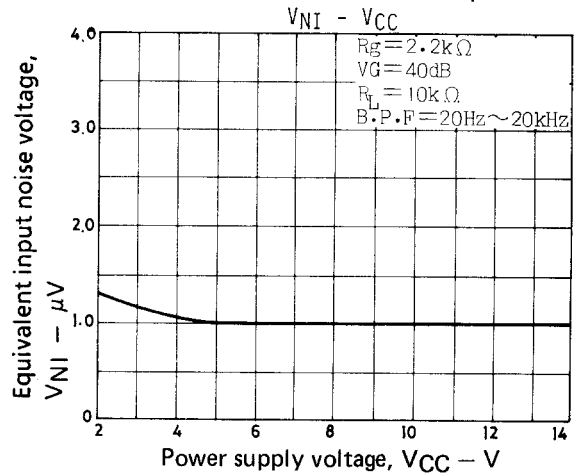
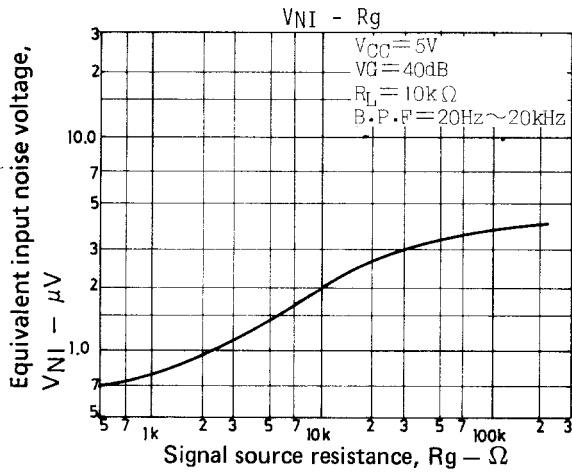


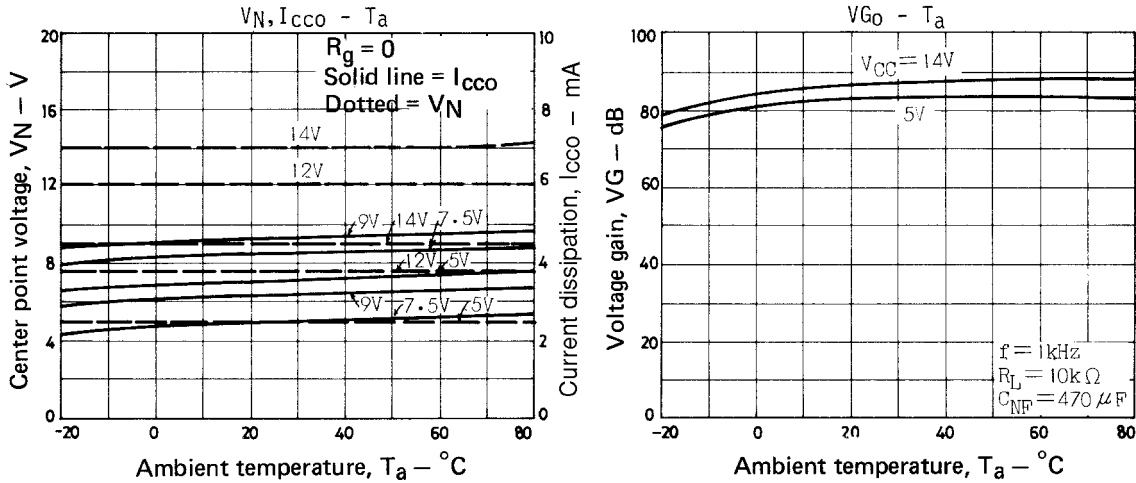
Unit (resistance:  $\Omega$ , capacitance: F)

Unit (resistance:  $\Omega$ , capacitance: F)



Unit (resistance:  $\Omega$ , capacitance: F)





- Specifications of any and all SANYO products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
- SANYO Electric Co., Ltd. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO products(including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of SANYO Electric Co., Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO product that you intend to use.
- Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

This catalog provides information as of January, 2000. Specifications and information herein are subject to change without notice.