Monolithic Linear IC

No. 1440E

LA4508

8.5W 2-CHANNEL AF POWER AMPLIFIER

Features
- Low idling current (20mA/2 channels)
- Output power 8.5W x 2 typ. (R_L = 3ohms)
- High ripple rejection (60dB at steady state)
- Small pop noise at the time of power supply ON
- Thermal protector
- Adoption of SEP14H (θ_J-C = 3°C/W) facilitates thermal design.

Maximum Ratings/T_A = 25°C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum supply voltage V_CCC</td>
<td>24 V</td>
</tr>
<tr>
<td>Allowable power dissipation P_d</td>
<td>15 W</td>
</tr>
<tr>
<td>Maximum output current I_o peak</td>
<td>2.5 A</td>
</tr>
<tr>
<td>Operating temperature T_opr</td>
<td>-20 to +75 °C</td>
</tr>
<tr>
<td>Storage temperature T_sta</td>
<td>-40 to +150 °C</td>
</tr>
</tbody>
</table>

Operating Conditions/T_A = 25°C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended supply voltage V_CCC</td>
<td>15 V</td>
</tr>
<tr>
<td>Operating voltage range V_CCC</td>
<td>9 to 23 V</td>
</tr>
<tr>
<td>Recommended load resistance R_L</td>
<td>3 Ω</td>
</tr>
</tbody>
</table>

Operating Characteristics/T_A = 25°C, V_CCC = 15V, R_L = 3Ω (2 channels), f = 1kHz, R_g = 600Ω,
See specified test circuit.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiescent current I_co</td>
<td>2 channels</td>
</tr>
<tr>
<td>Voltage gain VG</td>
<td>10 mA</td>
</tr>
<tr>
<td>Voltage gain difference ΔVG</td>
<td>42 dB</td>
</tr>
<tr>
<td>Output power P_o</td>
<td>44 dB</td>
</tr>
<tr>
<td>Total harmonic distortion THD</td>
<td>46 dB</td>
</tr>
<tr>
<td>Input resistance r_i</td>
<td>7.5 W</td>
</tr>
<tr>
<td>Output noise voltage V_NO1</td>
<td>8.5 W</td>
</tr>
<tr>
<td>Ripple rejection R_r</td>
<td>1.0 %</td>
</tr>
<tr>
<td>Channel separation ch sep</td>
<td>0.15 Ω</td>
</tr>
<tr>
<td>Output noise voltage V_NO2</td>
<td>30k Ω</td>
</tr>
<tr>
<td>Ripple rejection R_r</td>
<td>0.2 mV</td>
</tr>
<tr>
<td>Channel separation ch sep</td>
<td>0.5 mV</td>
</tr>
<tr>
<td>Ripple rejection R_r</td>
<td>0.3 mV</td>
</tr>
<tr>
<td>Channel separation ch sep</td>
<td>1.0 mV</td>
</tr>
</tbody>
</table>

Package Dimensions 3023A-S14HIC
(unit: mm)

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D0994JN/O147KI/8058/8064/N283 No.1440-1/7
**Equivalent Circuit**

![Circuit Diagram]

Unit (resistance: Ω, capacitance: F)

- **Sample Application Circuit**

![Application Circuit Diagram]

*1, *2: Connected when operating 9V sets
Sample Printed Circuit Pattern (Cu-foiled area)

Description of external parts

C1: Decoupling capacitor
   Used for the ripple filter. Since the rejection effect is saturated at a certain capacity, it is meaningless to increase the capacity more than needed. This capacitor, being also used for the time constant of the pop noise preventer, affects the starting time. Too small a capacity makes the pop noise level higher. (Recommended value: 100μF to 330μF)

C2 (C3): Feedback capacitor
   Since the low cutoff frequency depends on this feedback capacitor, the required bandwidth must be considered before determining the value of this feedback capacitor. This feedback capacitor also affects the starting time.

C4 (C5): Switching distortion suppressing capacitor
   Used to suppress switching distortion which often appears at high frequencies in overinput mode. The recommended value is 0.01μF (ceramic capacitor).

C6 (C7): Bootstrap capacitor
   The output at low frequencies depends on this capacitor. If the capacity is decreased, the output at low frequencies goes lower. 47μF min. is required. (This, however, does not apply if load Rl is light.)

C8 (C9): Output capacitor
   The low cutoff frequency depends on this output capacitor. (Refer to the characteristic graph.)

C10 (C11): Oscillation blocking capacitor
   Polyester film capacitor, being excellent in temperature characteristic, frequency characteristic, is used. The use of an aluminum electrolytic capacitor or ceramic capacitor may cause oscillation to occur at low temperatures.

C12: Power source capacitor
   This power source capacitor must accommodate loads (motor, etc.) in the power line or ripple in the transformer output. The recommended value is 1000μF to 2200μF.
**R1 (R2):** Normally, this resistor is not required. If the IC is used at \( V_{CC} = 9V \) or thereabouts, clip balance may be disturbed. This resistor can be used to correct such disturbance.

**D1:** When a motor is started, or in similar modes, the supply voltage drops abruptly, causing the filter transistor to be saturated. This diode is a bypass diode and can be used to prevent such saturation from occurring. Whether or not to use this diode depends on the set to be made.
Proper cares in using IC

1. 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 breakdown. Allow an ample margin of variation for supply voltage, etc. and use the IC in the range where the maximum rating is not exceeded.

2. Pin-to-pin short, inverted insertion
   If supply voltage is applied when the space between pins is shorted, breakdown or deterioration may occur. When mounting the IC on the board or applying supply voltage, make sure that the space between pins is not shorted with solder, etc. If the IC is inserted inversely, it may be broken down momentarily because of pin 7; Power Gnd, pin 8; VCC.

3. Load short
   If the IC is used with the load shorted for a long time, breakdown or deterioration may occur. Be sure not to short the load.

4. Change in closed-loop gain
   By connecting RNF in series with pins 3, 12 (NF pin), the gain can be reduced, but the following must be noted.
   a. If RNF is connected, the ripple bypass effect brought about by the NF capacitor is lessened, leading to insufficient ripple rejection.
   b. Do not operate at 40dB or less so that stable oscillation is maintained.

5. When the IC is used in radios or radio-cassette tape recorders, keep a good distance between IC and bar antenna. A capacitor of 0.022μF or more (polyester film capacitor) connected between pins 9 and 7 and between pins 6 and 7 acts effectively against radiation to the SW band.

6. Printed circuit board
   When making the board, refer to the sample printed circuit pattern. No feedback loop must be formed between input and output and make the line thick and short so that no common resistor exists between pre-GND and power-GND.

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7. Some plug jacks to be used for connecting to the external speaker are such that both poles are short-circuited once when connecting. In this case, the load is short-circuited, which may break down the IC.

8. Improvement in reduced voltage characteristic (Reference example).
By connecting parts as shown below, distortion-free operation can be performed at a supply voltage down to $V_{CC} = 4.5V$ or thereabouts. The capacitor of 100μF is connected to suppress pop noise.

![Diagram showing connection details]

Unit (resistance: Ω, capacitance: F)

Proper care in mounting radiator fin

1. The mounting torque is in the range of 4 to 6kg.cm.

2. The distance between screw holes of the radiator fin must coincide with the distance between screw holes of the IC. With case outline dimensions $L$ and $R$ referred to, the screws must be tightened with the distance between them as close to each other as possible.

3. The screw to be used must have a head equivalent to the truss machine screw or binder machine screw defined by JIS. Washers must be also used to protect the IC case.

4. No foreign matter such as cutting particles shall exist between heat sink and radiator fin. When applying grease on the junction surface, it must be applied uniformly on the whole surface.

5. IC lead pins are soldered to the printed circuit board after the radiator fin is mounted on the IC.