LA3161



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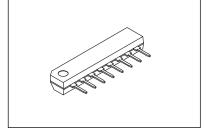
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Monolithic Linear IC

2-Channel Preamplifier for Car Stereo

Features

- On-chip 2 preamplifiers
- Good ripple rejection owing to on-chip voltage regulator
- Minimum number of external parts required
- 8-pin SIP package facilitating easy mounting
- Pin-compatible with LA3160



SIP8 22x4.5 / SIP8

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 |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Recommended Operating Conditions at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|-----------------|--------|------------|---------|------|
| Supply Voltage | Vcc | | 9 | V |
| Load Resistance | PI | | 10k | Ω |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

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

| Parameter | Symbol | Conditions | | Ratings | | | |
|--------------------------------|--------|-----------------------------------|-----|---------|------|------|--|
| Falanielei | Symbol | Conditions | | typ | max | Unit | |
| Current Dissipation | Icc | | | 6.5 | 8.0 | mA | |
| Voltage Cain | VG | Closed loop | | 35 | | dB | |
| Voltage Gain | VG | Open loop, V _O = 0.77V | 70 | 78 | | dB | |
| Output Voltage | Vo | THD = 1% | 1.0 | 1.3 | | V | |
| Total Hamonic Distortion | THD | V _O = 0.5V | | 0.05 | 0.30 | % | |
| Input Resistance | rį | | 70k | 100k | | Ω | |
| Equivalent Input Noise Voltage | VNI | $Rg = 2.2k\Omega$ | | 1.2 | 2.0 | μF | |
| Crosstalk | СТ | $Rg = 2.2k\Omega$ | -50 | -65 | | dB | |
| Ripple Rejection | Rr | | | -40 | | dB | |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

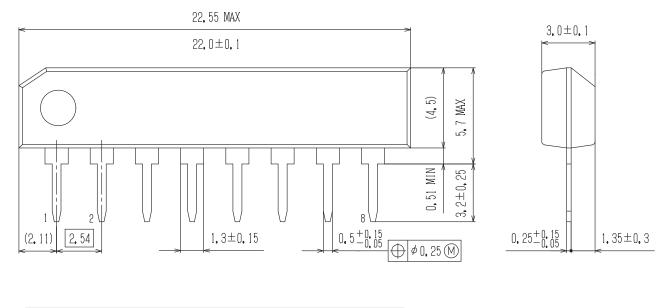
ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

Package Dimensions

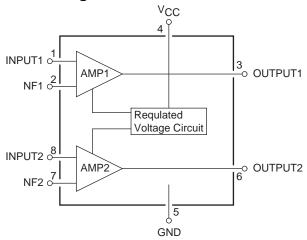
unit: mm

SIP8 22x4.5 / SIP8 CASE 127AG ISSUE O

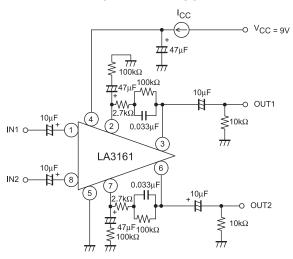




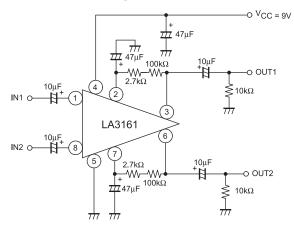
Block Diagram



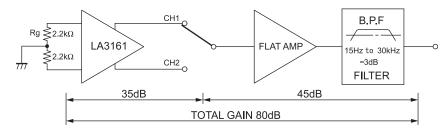
Test Circuit1 : V_O , VG, THD, I_{CC} , r_i



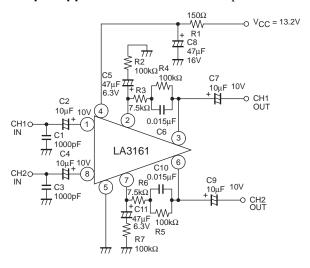
Test Circuit2: VGO

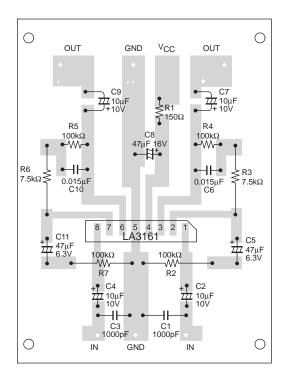


Test Circuit3: Noise



Sample Application Circuit 1: Preamplifier for Car Stereo





Function of External Parts

 C_2 , C_4 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. C_2 , C_4 also influence the operation start time and the adequate value of these capacitors is $10\mu F$. (Since C_2 , C_4 of less than $4.7\mu F$ make the operation start time longer, use C_2 , C_4 , of $4.7\mu F$ 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 fL:

C5 (C11) =
$$1/2\pi \cdot f_L \cdot R2$$
 (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 $47\mu F$.

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.

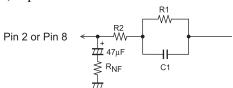
| Tape speed | 9.5cm/s | 4.75cm/s |
|--------------|---------|----------|
| C6 (R3 + R4) | 3180μs | 1590μs |
| R3 C6 | 90μs | 120µs |

 C_8 is bias capacitor for the power line. C_8 of $47\mu F$ is inserted at a point as close to the power supply pin (pin 4) as possible.

 C_1 , C_3 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 C_1 , C_3 is approximately 1000pF. C_7 , C_9 are output coupling capacitors. The adequate value of C_7 , C_9 is 10μ F.

NAB element and determination of gain

Since the DC feedback is provided by R_1 , R_2 of NAB element, which brings about DC output potential at pins 3, 6, it is impossible to change the value of R_1 , R_2 of NAB element greatly. Therefore, when determining the gain, change R_{NF} with R_1 , R_2 , C_1 (NAB element) kept constant.



(1) How to obtain RNF

Impedance Z of NAB element is

$$\begin{split} Z = & \frac{1}{1/R1 + j\omega C1} + R2 \\ = & \left(R1 + R2\right) \left\{ \frac{1 + j\omega C1 \{R1 \ R2/(R1 + R2)\}}{1 + j\omega C1R1} \right\} \end{split}$$

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 $R_{NF} = Z/A$.

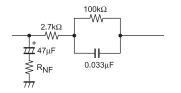
 $A = (VG \text{ for } 1kHz) \text{ times, (Set } R_1, R_2 \text{ at approximately } 100k\Omega)$

Each time constant of NAB characteristic.

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

(2) Examples of NAB Constants

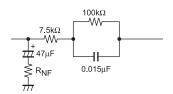
(a) Tape speed: 9.5cm/s. (8 tracks)



 $VG : R_{NF} (VG/f = 1kHz)$

| VG | 30 | 35 | 40 | dB |
|-----|-----|-----|----|----|
| RNE | 180 | 100 | 56 | Ω |

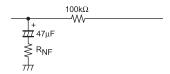
(b) Tape speed: 4.75cm/s. (cassette)



VG: RNF

| VG | 30 | 35 | 40 | dB |
|-----------------|-----|-----|-----|----|
| R _{NF} | 440 | 240 | 130 | Ω |

(c) Flat amplifier



VG: RNF

| VG | 30 | 35 | 40 | dB |
|-----------------|-----|-----|----|----|
| R _{NF} | 3.2 | 1.8 | 1 | kΩ |

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.

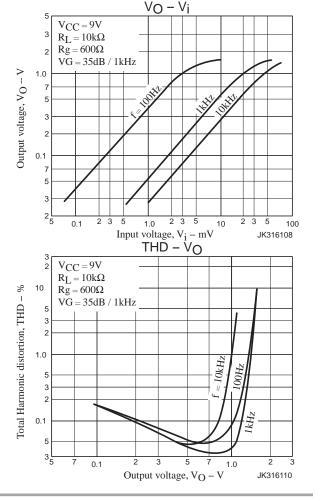
3. Breakdown of IC attributable to inverted insertion

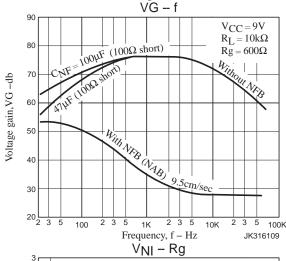
If the IC is inserted inversely and operated, the IC may suffer from something unusual, thereby leading to a breakdown or deterioration of the IC. When installing the IC on the board or operating the IC, check the marked surface of IC.

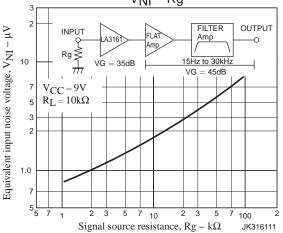
Proper cares to be taken for obtaining optimum operation of IC

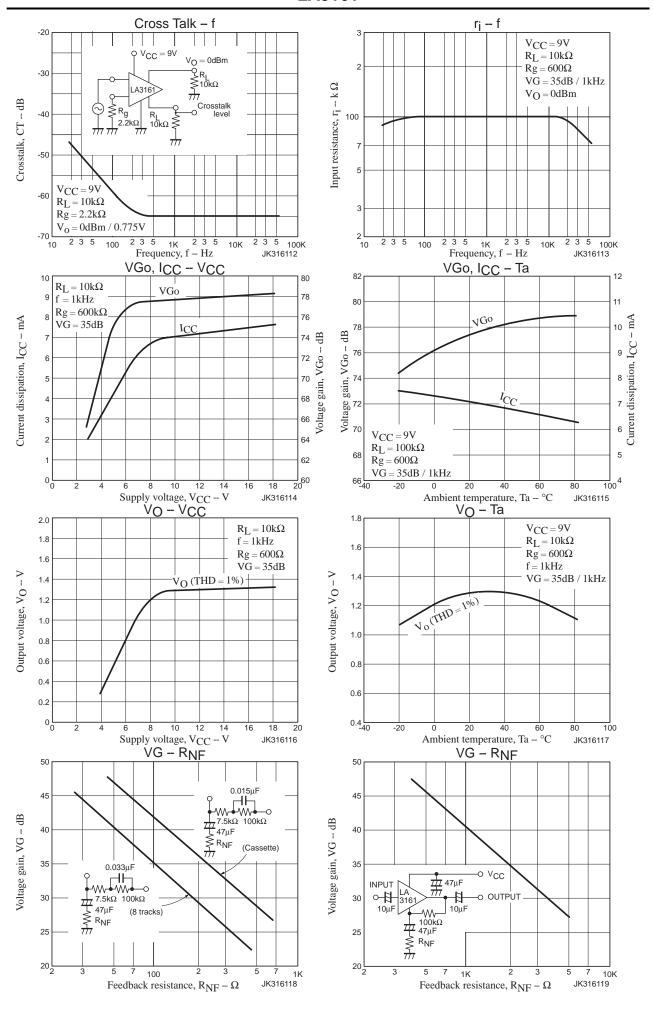
• Set DC resistance of R_1 , R_2 of NAB element at approximately $100k\Omega$.

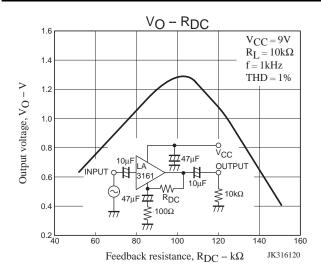
• Determine the gain by changing RNF without chaging NAB constant (Refer to Examples of NAB constant.).











ORDERING INFORMATION

| Device | Package | Shipping (Qty / Packing) |
|----------|---------------------------------|--------------------------|
| LA3161-E | SIP8 22x4.5 / SIP8 (Pb-Free) | 25 / Fan-Fold |

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