5.8W DUAL AUDIO POWER AMPLIFIER.  
22W BTL AUDIO POWER AMPLIFIER.

The KIA6281H is dual audio power amplifier for consumer application. It is designed for high power, low distortion and low noise. It also contains various kind of protectors. It is suitable for car audio power amplifier with high performance.

FEATURES

- High Power
  \( P_{\text{OUT(D)}}=22\text{W (Typ.)} \)
  \( (V_{\text{CC}}=14.4\text{V}, f=1\text{kHz}, \text{THD}=10\%, R_{\text{L}}=4\Omega, \text{BTL}) \)
  \( P_{\text{OUT(BTL)}}=19\text{W (Typ.)} \)
  \( (V_{\text{CC}}=13.2\text{V}, f=1\text{kHz}, \text{THD}=10\%, R_{\text{L}}=4\Omega, \text{BTL}) \)
  \( P_{\text{OUT(DUAL)}}=15\text{W (Typ.)} \)
  \( (V_{\text{CC}}=13.2\text{V}, f=1\text{kHz}, \text{THD}=1\%, R_{\text{L}}=4\Omega, \text{BTL}) \)
  \( P_{\text{OUT(DUAL)}}=5.8\text{W (Typ.) /ch} \)
  \( (V_{\text{CC}}=13.2\text{V}, f=1\text{kHz}, \text{THD}=10\%, R_{\text{L}}=4\Omega, \text{DUAL}) \).

- Low Distortion
  \( \text{THD(1)}=0.03\% (\text{Typ.}) \)
  \( (V_{\text{CC}}=13.2\text{V}, f=1\text{kHz}, P_{\text{OUT}}=4\text{W}, G_{\text{V}}=40\text{dB}, R_{\text{L}}=4\Omega, \text{BTL}) \)
  \( \text{THD(2)}=0.06\% (\text{Typ.}) \)
  \( (V_{\text{CC}}=13.2\text{V}, f=1\text{kHz}, P_{\text{OUT}}=1\text{W}, G_{\text{V}}=32\text{dB}, R_{\text{L}}=4\Omega, \text{DUAL}) \).

- Low Noise
  \( V_{\text{NO(1)}}=0.14mV_{\text{rms}} (\text{Typ.}) \)
  \( (V_{\text{CC}}=13.2\text{V}, R_{\text{L}}=4\Omega, G_{\text{V}}=40\text{dB}, R_{\text{G}}=0, \text{DIN Noise : DIN45405}) \)
  \( V_{\text{NO(2)}}=0.7mV_{\text{rms}} (\text{Typ.}) \)
  \( (V_{\text{CC}}=13.2\text{V}, R_{\text{L}}=4\Omega, G_{\text{V}}=32\text{dB}, R_{\text{G}}=10k\Omega, \text{BW}=20\text{Hz} \sim 20\text{kHz, DUAL}) \).

- Protector Circuit
  Thermal shut down, over voltage protection

- Operating supply voltage range
  \( V_{\text{CC}}=9 \sim 18\text{V} \).
### MAXIMUM RATINGS (Ta=25°C)

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>SYMBOL</th>
<th>RATING</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Supply Voltage (0.2 sec)</td>
<td>$V_{CC}$ surge</td>
<td>45</td>
<td>V</td>
</tr>
<tr>
<td>DC Supply Voltage</td>
<td>$V_{CC}$ DC</td>
<td>25</td>
<td>V</td>
</tr>
<tr>
<td>Operating Supply Voltage</td>
<td>$V_{CC}$ opr</td>
<td>18</td>
<td>V</td>
</tr>
<tr>
<td>Output Current (Peak)</td>
<td>$I_0$ (peak)</td>
<td>4.5</td>
<td>A</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>$P_0$</td>
<td>25</td>
<td>W</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>$T_{oper}$</td>
<td>-30~85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>$T_{stg}$</td>
<td>-55~150</td>
<td>°C</td>
</tr>
</tbody>
</table>

### ELECTRICAL CHARACTERISTICS
(Unless otherwise specified, $V_{CC}$=13.2V, $R_L$=4Ω, $R_g$=600Ω, f=1kHz, Ta=25°C)

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>SYMBOL</th>
<th>TEST CIRCUIT</th>
<th>TEST CONDITION</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiescent Current</td>
<td>$I_{CCQ}$</td>
<td>2</td>
<td>$V_{IN}$=0</td>
<td>-</td>
<td>80</td>
<td>145</td>
<td>mA</td>
</tr>
<tr>
<td><strong>BTL Mode</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Power</td>
<td>$P_{OUT}(1)$</td>
<td>1</td>
<td>$V_{CC}$=14.4V, THD=10%</td>
<td>-</td>
<td>22</td>
<td>-</td>
<td>W</td>
</tr>
<tr>
<td>Output Power</td>
<td>$P_{OUT}(2)$</td>
<td>1</td>
<td>THD=10%</td>
<td>-</td>
<td>19</td>
<td>-</td>
<td>W</td>
</tr>
<tr>
<td>Output Power</td>
<td>$P_{OUT}(3)$</td>
<td>1</td>
<td>THD=1%</td>
<td>-</td>
<td>15</td>
<td>-</td>
<td>W</td>
</tr>
<tr>
<td>Total Harmonic Distortion</td>
<td>THD(1)</td>
<td>1</td>
<td>$P_{OUT}$=4W, $G_V$=40dB</td>
<td>-</td>
<td>0.03</td>
<td>0.25</td>
<td>%</td>
</tr>
<tr>
<td>Output Offset Voltage</td>
<td>$V_{OFF}$</td>
<td>1</td>
<td>$V_{IN}$=0</td>
<td>-</td>
<td>0</td>
<td>0.35</td>
<td>V</td>
</tr>
<tr>
<td>Voltage Gain</td>
<td>$G_V(1)$</td>
<td>1</td>
<td>$V_{OUT}$=0dBm</td>
<td>-</td>
<td>40</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Output Noise Voltage</td>
<td>$V_{NO}(1)$</td>
<td>1</td>
<td>$R_g$=0, BW=20Hz~20kHz</td>
<td>-</td>
<td>0.14</td>
<td>-</td>
<td>mVrms</td>
</tr>
<tr>
<td>Ripple Rejection Ratio</td>
<td>R.R(1)</td>
<td>1</td>
<td>$f_{rb}=100Hz$, $V_{rb}$=0dBm</td>
<td>-</td>
<td>-52</td>
<td>-40</td>
<td>dB</td>
</tr>
<tr>
<td><strong>Dual Mode</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Power</td>
<td>$P_{OUT}(4)$</td>
<td>2</td>
<td>THD=10%</td>
<td>5</td>
<td>5.8</td>
<td>-</td>
<td>W</td>
</tr>
<tr>
<td>Total Harmonic Distortion</td>
<td>THD(2)</td>
<td>2</td>
<td>$P_{OUT}$=1W</td>
<td>-</td>
<td>0.06</td>
<td>0.30</td>
<td>%</td>
</tr>
<tr>
<td>Voltage Gain</td>
<td>$G_V(2)$</td>
<td>2</td>
<td>$V_{OUT}$=0dBm</td>
<td>50</td>
<td>52</td>
<td>54</td>
<td>dB</td>
</tr>
<tr>
<td>Voltage Gain Ratio</td>
<td>$\triangle G_V$</td>
<td>2</td>
<td>$V_{OUT}$=0dBm</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>dB</td>
</tr>
<tr>
<td>Output Noise Voltage</td>
<td>$V_{NO}(2)$</td>
<td>2</td>
<td>$R_g$=10kΩ, BW=20Hz~20kHz</td>
<td>-</td>
<td>0.7</td>
<td>1.5</td>
<td>mVrms</td>
</tr>
<tr>
<td>Ripple Rejection Ratio</td>
<td>R.R(2)</td>
<td>2</td>
<td>$f_{rb}=100Hz$, $V_{rb}$=0dBm</td>
<td>-</td>
<td>-52</td>
<td>-40</td>
<td>dB</td>
</tr>
<tr>
<td>Cross Talk</td>
<td>C.T</td>
<td>2</td>
<td>$V_{OUT}$=0dBm, $R_g$=600Ω</td>
<td>-</td>
<td>-57</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Input Resistance</td>
<td>$R_{IN}$</td>
<td>2</td>
<td></td>
<td>-</td>
<td>33</td>
<td>-</td>
<td>kΩ</td>
</tr>
</tbody>
</table>
TEST CIRCUIT / APPLICATION CIRCUIT

(1) BTL MODE

(2) DUAL MODE

1997. 5. 8  Revision No : 0  KEC
TYPICAL VOLTAGE OF EACH TERMINAL
(VCC=13.2V, Ta=25°C, DUAL MODE TEST CIRCUIT)

<table>
<thead>
<tr>
<th>TERMINAL NO.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Voltage(V)</td>
<td>6.4</td>
<td>12.3</td>
<td>VCC</td>
<td>GND</td>
<td>12.3</td>
<td>6.4</td>
<td>6.4</td>
<td>1.5</td>
<td>1.5</td>
<td>GND</td>
<td>1.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

APPLICATION INFORMATION

1. VOLTAGE GAIN ADJUSTMENT
1.1 DUAL AMPLIFIER

The voltage gain \( G_V \) is determined by \( R_i, R_e \) and \( R_t \) in Fig. 1.

\[
G_V = 20 \log \frac{R_f + R_1 + R_2}{R_f + R_1} \text{ (dB)}
\]

In case of \( R_i = 0 \)

The voltage gain is set as follows: \( G_V = 53 \text{dB} \) (Typ.)

![Fig. 1](image1)

(2) BTL AMPLIFIER

The recommended BTL connection amplifier shown in Fig. 2.

![Fig. 2](image2)
Amp. 1 is noninverting amplifier and Amp. 2 is invert one.
The output voltage is divided by resistors \( R_3 \) and \( R_4 \).
The divided voltage is applied to inverting input of Amp. 2.
\( R_3 \) and \( R_4 \) are determined in the following equation.

\[
20 \log \frac{R_3 + R_4}{R_4} = 20 \log \frac{R_1 + R_3 + R_2}{R_1 + R_2} (\text{dB}) \quad G_V \text{ in Dual Mode}
\]

The voltage gain in this circuit is 6dB higher than that in Dual Mode.

\[
G_V = 20 \log \frac{R_1 + R_2}{R_1} + 3(dB)
\]

In case of \( R=0 \)
\[
G_V = 52 + 6 = 58(\text{dB})
\]

In case of \( R=430\Omega \)
\[
G_V = 34 + 6 = 40(\text{dB})
\]

Each voltage gain can be set as shown above.

2. MUTING

Audio muting can be accomplished by connecting pin 7 (ripple filter) to GND as shown in Fig. 3.
Then, the bias circuits are cut off.
However, caution must be exercised to the following items.

(1) The recovery time from the muting operation is determined by the capacities of the ripple filter capacitor between \( \oplus \) pin and GND, and of the capacitor for NF.

(2) As this muting system is operated by the short-circuit of ripple filter : C5, the ripple rejection ratio becomes worse in the muting condition.
At mute ON, some pop noises of breaking the bias are produced.
The output waveform at muting ON/OFF during BTL, are shown in fig. 4.
(Provided \( V_{CC}=13.2\,\text{V} \), \( R_L=4\,\Omega \), non-signal.)
50dB or more can be obtained for muting amount.

\[ V_{CC}=13.2\,\text{V}, \quad R_L=4\,\Omega, \quad \text{INPUT SHORT, BTL} \]

**Fig. 4**

3. MEASURES AGAINST OSCILLATION

- C7, C8, C9, C12: The capacitor of polyester film having small variation of the
temperature characteristics is recommended as the capacitor
for oscillation prevention.
- C13: Reduces the gain in the high range frequency (150kHz or over)
  and increases the oscillation allowance.
- R1: Increases the oscillation allowance at output cripping of the
  low range frequency (100Hz or less).

Since the oscillation allowance varies according to the following items, carry out the
temperature test to confirm the oscillation allowance.

1. Gain to be used (\( G_v \) setting).
2. Capacity of capacitor
3. Kinds of capacitor
4. Layout of printed board
It is recommended to use the capacitor having the capacity exceeding the oscillation stopping value.
At using with the voltage gain $G_v$ lowered or with the high range frequency and the oscillation becomes liable to be produced.
Therefore, application with $G_v=40\text{dB}$ or over is advisable.
Especially for using with the gain lowered in DUAL operation, insert $1000\text{pF}$ between NF (9 pin and 11 pin) and GND.
This capacitor reduces the gain of the high range frequency and is effective for oscillation prevention.

4. OUTPUT WAVEFORM AT POWER SUPPLY ON/OFF
   BTL and dual Amplifier DC output waveforms in the condition of $V_{CC}=13.2V$,
   $R_t=4\Omega$ at non-signal (input short) are shown in Fig. 5 and 6.

![Graph showing output waveform](image)

**Fig. 5  BTL OPERATION**
The popping time at power supply ON/OFF varies according to the rise and fall times. The condition in which the power supply is rapidly and repeatedly made ON/OFF, that is, the condition in which the charge is made on the external capacitor of IC is different from the conditions shown in Fig. 5 and Fig. 6.