LOW VOLTAGE AUDIO POWER AMPLIFIER

■ GENERAL DESCRIPTION
The NJM2113 is an audio power amplifier designed for telephone application, such as in speakerphones. Coupling capacitors to the speaker are not required as it has differential speaker outputs.

The closed loop gain is set with two external resistors.
A CD pin permit powering down with muting the input signal.

■ FEATURES
● Wide Operating Voltage (2~16V)
● Low Operating Current (2.7mA Typ.)
● CD Input to Power Down the IC with Mute
● Low Power-Down Operating Current (72μA Typ.)
● Output Power Exceeds 250mW (V+=6V, RL=32Ω)
● Gain Adjustable (GVD=0~43dB, Voice Band)
● Package Outline DMP8, DIP8, SOP8 JEDEC 150mil
   SIP8, SSOP8, VSP8
● Bipolar Technology

■ RECOMMENDED OPERATING CONDITIONS
● Load Impedance RL 8~200Ω
● Differential Gain GVD 0~43dB (5kHz bandwidth)
● Input Voltage at CD VCD 0~V+ Vdc

■ PIN CONFIGURATION

■ BLOCK DIAGRAM
## ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>RATINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>V+</td>
<td>+18 V</td>
</tr>
<tr>
<td>Output Peak Current</td>
<td>IOP</td>
<td>±250 mA</td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>VIN</td>
<td>(1~4pin):0.3 to V+0.3 (5.8pin):0.3 to V+0.3</td>
</tr>
<tr>
<td>(when Power-Down)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>PD</td>
<td>mW</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>Tstg</td>
<td>-40~+125°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>Tso</td>
<td>-20~+75°C</td>
</tr>
</tbody>
</table>

(1) Device itself.  
(2) Mounted on PC Board.

## ELECTRICAL CHARACTERISTICS

(V+ = 6V, Ta = 25°C, unless otherwise specified)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>TEST CONDITION</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Current (no signal)</td>
<td>Icc1</td>
<td>V+ = 3.0V, R+ = ∞, 1pin = 0.8V</td>
<td>-</td>
<td>2.7</td>
<td>4.0</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>Icc2</td>
<td>V+ = 16.0V, R+ = ∞, 1pin = 0.8V</td>
<td>-</td>
<td>3.4</td>
<td>5.0</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>Iced</td>
<td>V+ = 3.0V, R+ = ∞, 1pin = 2.0V</td>
<td>-</td>
<td>72</td>
<td>100</td>
<td>μA</td>
</tr>
<tr>
<td>Open Loop Gain</td>
<td>Av1</td>
<td>Amplifier A, f &lt; 100Hz</td>
<td>77</td>
<td>83</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Closed Loop Gain</td>
<td>Av2</td>
<td>Amplifier B, f = 1kHz, R+ = 32Ω</td>
<td>-0.35</td>
<td>0</td>
<td>+0.35</td>
<td>dB</td>
</tr>
<tr>
<td>Output Power</td>
<td>PO1</td>
<td>V+ = 3.0V, R+ = 16Ω, THD = 10%</td>
<td>55</td>
<td>-</td>
<td>-</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>PO2</td>
<td>V+ = 6.0V, R+ = 32Ω, THD = 10%</td>
<td>250</td>
<td>-</td>
<td>-</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>PO3</td>
<td>V+ = 12.0V, R+ = 100Ω, THD = 10%</td>
<td>400</td>
<td>-</td>
<td>-</td>
<td>mW</td>
</tr>
<tr>
<td>Total Harmonic Distortion</td>
<td>THD1</td>
<td>V+ = 6V, R+ = 32Ω, Pout = 125mW, Gvd = 34dB</td>
<td>-</td>
<td>0.5</td>
<td>1.0</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>THD2</td>
<td>V+ = 3V, R+ = 30Ω, Pout = 20mW, Gvd = 12dB</td>
<td>-</td>
<td>0.5</td>
<td>-</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>THD3</td>
<td>V+ = 12V, R+ = 32Ω, Pout = 200mW, Gvd = 34dB</td>
<td>-</td>
<td>0.6</td>
<td>-</td>
<td>%</td>
</tr>
<tr>
<td>Power Supply Rejection Ratio</td>
<td>PSRR1</td>
<td>C1 = ∞, C2 = 0.01μF, DC</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td></td>
<td>PSRR2</td>
<td>C1 = 0.1μF, C2 = 0.5μF, f = 1kHz</td>
<td>-</td>
<td>12</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td></td>
<td>PSRR3</td>
<td>C1 = 1.0μF, C2 = 5.0μF, f = 1kHz</td>
<td>-</td>
<td>52</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Mute Attenuation</td>
<td>MAT</td>
<td>f = 1kHz, R+ = 100Ω, Pout = 20mW</td>
<td>-</td>
<td>70</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Output Voltage (R = 75kΩ, DC)</td>
<td>VO1</td>
<td>V+ = 3.0V, R+ = 16Ω</td>
<td>1.00</td>
<td>1.18</td>
<td>1.25</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>V02</td>
<td>V+ = 6.0V</td>
<td>-</td>
<td>2.68</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>V03</td>
<td>V+ = 12.0V</td>
<td>-</td>
<td>5.71</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Output High Level</td>
<td>Voh</td>
<td>Iout = 75mA, V+ = 2.0~16.0V</td>
<td>-</td>
<td>-</td>
<td>V+ - 1.1</td>
<td>V</td>
</tr>
<tr>
<td>Output Low Level</td>
<td>Vol</td>
<td>Iout = 75mA, V+ = 2.0~16.0V</td>
<td>-</td>
<td>0.21</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Output DC Offset</td>
<td>ΔVo</td>
<td>R+ = 75kΩ, R+ = 32Ω, 5pin~8pin</td>
<td>30</td>
<td>0</td>
<td>+30</td>
<td>mV</td>
</tr>
<tr>
<td>Input Bias Current</td>
<td>Is</td>
<td>4pin</td>
<td>-</td>
<td>-</td>
<td>-30</td>
<td>200</td>
</tr>
<tr>
<td>Equivalent Resistance</td>
<td>Rin</td>
<td>3pin</td>
<td>100</td>
<td>150</td>
<td>220</td>
<td>kΩ</td>
</tr>
<tr>
<td></td>
<td>Rref</td>
<td>2pin</td>
<td>18</td>
<td>25</td>
<td>40</td>
<td>kΩ</td>
</tr>
<tr>
<td>CD Input Voltage H</td>
<td>Vcdh</td>
<td>1pin</td>
<td>2.0</td>
<td>-</td>
<td>V+</td>
<td>V</td>
</tr>
<tr>
<td>CD Input Voltage L</td>
<td>Vcdl</td>
<td>1pin</td>
<td>0.0</td>
<td>-</td>
<td>0.8</td>
<td>V</td>
</tr>
<tr>
<td>CD Input Resistance</td>
<td>Rcd</td>
<td>Vcd = 16.0V, 1pin</td>
<td>50</td>
<td>75</td>
<td>175</td>
<td>kΩ</td>
</tr>
</tbody>
</table>

(3) NJM2113M, NJM2113V : At on PC Board  
(4) Not specified for NJM2113V, NJM2113R
The NJM2113 is active mode during the CD terminal is Low level ( <0.8V ) and it is stand-by mode during the CD terminal is High level ( >2.0V )

2. C1 and C2 improve power supply rejection ratio.
   In case of C1 is enough large,C2 is unnecessary.

3. Please note that the C1 and C2 make slow power rise up to the NJM2113 regardless the external power supply condition.

4. Input current flow on the internal resistor shown in the equivalent circuit of CD terminal.

5. No snubber resistor and capacitor are required normally.
   But the snubber resistor and capacitor are required if the NJM2113 oscillates by Condition of PCB layout,stray capacitor and speaker wire length.
TYPICAL CHARACTERISTICS

AMP#A Loop Gain, Phase vs. Frequency

- Voltage Gain (dB)
- Phase

Power Dissipation vs. Output Power

\( \text{\( R_L = 8\Omega \), \( f = 1kHz \)} \)

\( V^* = 12V \)
\( V^* = 8V \)
\( V^* = 6V \)
\( V^* = 3V \)

Power Dissipation vs. Output Power

\( \text{\( R_L = 16\Omega \), \( f = 1kHz \)} \)

\( V^* = 12V \)
\( V^* = 6V \)

Power Dissipation vs. Output Power

\( \text{\( R_L = 32\Omega \), \( f = 1kHz \)} \)

\( V^* = 12V \)
\( V^* = 6V \)

Power Dissipation vs. Output Power

\( \text{\( R_L = 100\Omega \), \( f = 1kHz \)} \)

\( V^* = 12V \)
\( V^* = 6V \)
TYPICAL CHARACTERISTICS

Operating Current vs. Supply Voltage

CD Terminal Sink Current vs. Apply Voltage

Power Supply Rejection Ratio vs. Frequency

(C2=0.05μF)

(C2=1μF)

(C2=8μF)

(C2=10μF)
TYPICAL CHARACTERISTICS

**Total Harmonic Distortion vs. Output Power**

At 1kHz, $\Delta V = 34\,\text{dB}$

- $V^* = 3V, R_L = 60\Omega$
- $V^* = 6V, R_L = 20\Omega$
- $V^* = 12V, R_L = 20\Omega$

**Total Harmonic Distortion vs. Output Power**

At 3kHz, $\Delta V = 34\,\text{dB}$

- $V^* = 3V, R_L = 60\Omega$
- $V^* = 6V, R_L = 20\Omega$
- $V^* = 12V, R_L = 20\Omega$

**Total Harmonic Distortion vs. Output Power**

At 1.3kHz, $\Delta V = 12\,\text{dB}$

- $V^* = 3V, R_L = 60\Omega$
- $V^* = 6V, R_L = 20\Omega$
- $V^* = 12V, R_L = 20\Omega$

**Operating Current vs. Ambient Temperature**

- $V^* = 18V$
- $V^* = 9V$

**Operating Current vs. Ambient Temperature**

At Power Down Mode

- $V^* = 3V, V_{CE} = 2V$

**CAUTION**

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