ICs for Audio Common Use

AN7560Z

BTL output power IC for car audio

■ Overview

The AN7560Z is an audio power IC developed as the sound output of car audio (35 W by 4-ch.). A capacitor and resistor to stop oscillation are built in between the output pin and GND so that a space saving of set is possible. Also, it incorporates a perfect muting circuit without shock noise so that a shock noise design under the set transient condition can be made easily when used together with its standby function. In addition, it incorporates various protection circuits to protect the IC from destruction by GND-open-shortcircuit to ground and power supply surge which are the important subject of power IC protection. This IC will largely contribute to a high reliability design of the equipment.

■ Features

• A pattern layout in which input and output pattern do not intersect each other on single-sided printed circuit board is possible.
• Incorporating various protection circuits (temperature, shortcircuit to V CC, V CC-open short circuit to V CC, shortcircuit to GND, GND-open short circuit to GND, overvoltage, power supply surge, and ASO, etc.)
• Built-in standby function (shock noise-free when STB-on/off)
• Built-in muting function (shock noise-free when Mute-on/off)
• External components reduction
• Provided with beep sound input pin
• Equipped with auxiliary sound input pin

■ Applications

• Car stereo, miniature audio component, karaoke and other audio equipment.
AN7560Z ICs for Audio Common Use

- **Block Diagram**

  - **Pin Descriptions**
    | Pin No. | Description                     | Pin No. | Description                  |
    |---------|---------------------------------|---------|------------------------------|
    | 1       | ch.4 Output (+)                 | 14      | GND(Output ch.1)             |
    | 2       | GND (Output ch.4)               | 15      | ch.1 Output (+)              |
    | 3       | ch.4 Output (−)                 | 16      | Standby                      |
    | 4       | V_CC                            | 17      | ch.1 Input                   |
    | 5       | ch.3 Output (+)                 | 18      | Beep Sound Input             |
    | 6       | GND(Output ch.3)                | 19      | ch.2 Input                   |
    | 7       | ch.3 Output (−)                 | 20      | GND (Input)                  |
    | 8       | GND (Output ch.2)               | 21      | ch.4 Input                   |
    | 9       | ch.2 Output (+)                 | 22      | GND (Sub)                    |
    | 10      | Auxiliary sound input           | 23      | ch.3 Input                   |
    | 11      | ch.2 Output (−)                 | 24      | Muting                       |
    | 12      | V_CC                            | 25      | Ripple Filter                |
    | 13      | ch.1 Output (+)                 |         |                              |

- **Absolute Maximum Ratings**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage *²</td>
<td>V_CC</td>
<td>25</td>
<td>V</td>
</tr>
<tr>
<td>Peak supply voltage *³</td>
<td>V_surge</td>
<td>65</td>
<td>V</td>
</tr>
<tr>
<td>Supply current</td>
<td>I_CC</td>
<td>12</td>
<td>A</td>
</tr>
<tr>
<td>Power dissipation *⁴</td>
<td>P_D</td>
<td>59</td>
<td>W</td>
</tr>
<tr>
<td>Operating ambient temperature *¹</td>
<td>T_opr</td>
<td>−30 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature *¹</td>
<td>T_stg</td>
<td>−55 to +150</td>
<td>°C</td>
</tr>
</tbody>
</table>

  **Note:**
  *¹: All items are at T_a = 25°C, except for the operating ambient temperature and storage temperature.
  *²: Without signal
  *³: Time = 0.2 s.
  *⁴: Power dissipation at T_a = 85°C.
ICs for Audio Common Use

**Recommended Operating Range**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Range</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>VCC</td>
<td>8.0 to 18.0</td>
<td>V</td>
</tr>
</tbody>
</table>

**Electrical Characteristics at VCC = 13.2 V, f = 1 kHz, Ta = 25°C**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiescent current</td>
<td>ICQ</td>
<td>Rg = 10 kΩ, RL = 4 Ω</td>
<td>—</td>
<td>300</td>
<td>450</td>
<td>mA</td>
</tr>
<tr>
<td>Standby current</td>
<td>ISTB</td>
<td>Rg = 10 kΩ, RL = 4 Ω</td>
<td>—</td>
<td>1</td>
<td>10</td>
<td>μA</td>
</tr>
<tr>
<td>Output noise voltage*1</td>
<td>VNO</td>
<td>Rg = 10 kΩ, RL = 4 Ω</td>
<td>—</td>
<td>0.15</td>
<td>0.5</td>
<td>mV[rms]</td>
</tr>
<tr>
<td>Voltage gain</td>
<td>GV</td>
<td>VIN = 40 mV[rms], RL = 4 Ω</td>
<td>32</td>
<td>34</td>
<td>36</td>
<td>dB</td>
</tr>
<tr>
<td>Total harmonic distortion 1</td>
<td>THD1</td>
<td>VIN = 40 mV[rms], RL = 4 Ω</td>
<td>—</td>
<td>0.05</td>
<td>0.2</td>
<td>%</td>
</tr>
<tr>
<td>Maximum output power 1</td>
<td>PO1</td>
<td>THD = 10%, RL = 4 Ω</td>
<td>16</td>
<td>19.5</td>
<td>—</td>
<td>W</td>
</tr>
<tr>
<td>Ripple rejection*1</td>
<td>RR</td>
<td>Rg = 10 kΩ, RL = 4 Ω</td>
<td>60</td>
<td>68</td>
<td>—</td>
<td>dB</td>
</tr>
<tr>
<td>Channel balance</td>
<td>CB</td>
<td>VIN = 40 mV[rms], RL = 4 Ω</td>
<td>—</td>
<td>0</td>
<td>1</td>
<td>dB</td>
</tr>
<tr>
<td>Cross-talk</td>
<td>CT</td>
<td>Rg = 10 kΩ, RL = 4 Ω</td>
<td>60</td>
<td>70</td>
<td>—</td>
<td>dB</td>
</tr>
<tr>
<td>Output offset voltage</td>
<td>VOFF</td>
<td>Rg = 10 kΩ, RL = 4 Ω</td>
<td>—250</td>
<td>0</td>
<td>250</td>
<td>mV</td>
</tr>
<tr>
<td>Muting effect*1</td>
<td>MT</td>
<td>VIN = 40 mV[rms], RL = 4 Ω</td>
<td>70</td>
<td>86</td>
<td>—</td>
<td>dB</td>
</tr>
<tr>
<td>Input impedance</td>
<td>ZI</td>
<td>VIN ± 0.3 VDC</td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>kΩ</td>
</tr>
<tr>
<td>Shock noise*2</td>
<td>VS</td>
<td>Rg = 10 kΩ, RL = 4 Ω</td>
<td>—100</td>
<td>0</td>
<td>100</td>
<td>mV[0-P]</td>
</tr>
<tr>
<td>Total harmonic distortion 2</td>
<td>THD2</td>
<td>VIN = 20 mV[rms], fIN = 20 kHz, RL = 4 Ω</td>
<td>—</td>
<td>0.1</td>
<td>0.5</td>
<td>%</td>
</tr>
<tr>
<td>Mute On threshold voltage</td>
<td>MTON</td>
<td>VIN = 40 mV[rms], RL = 4 Ω</td>
<td>4</td>
<td>—</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td>Mute Off threshold voltage</td>
<td>MTOFF</td>
<td>VIN = 40 mV[rms], RL = 4 Ω</td>
<td>—</td>
<td>—</td>
<td>0.8</td>
<td>V</td>
</tr>
<tr>
<td>Maximum output power 2</td>
<td>PO2</td>
<td>VIN = 1 V[rms], RL = 4 Ω</td>
<td>—</td>
<td>28</td>
<td>—</td>
<td>W</td>
</tr>
<tr>
<td>Maximum output power 3</td>
<td>PO3</td>
<td>VCC = 14.4 V, THD = 10%, RL = 4 Ω</td>
<td>—</td>
<td>21</td>
<td>—</td>
<td>W</td>
</tr>
<tr>
<td>Maximum output power 4</td>
<td>PO4</td>
<td>VCC = 14.4 V, VIN = 1 V[rms], RL = 4 Ω</td>
<td>—</td>
<td>34</td>
<td>—</td>
<td>W</td>
</tr>
</tbody>
</table>

Note) *1: Measurement using a bandwidth 15 Hz to 30 kHz (12 dB/OCT) filter.
*2: Change over the standby terminal at the time shown in the right.

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**Panasonic**

3
### Technical Information

1. $P_D - T_a$ curves of HZIP025-P-0980

![Graph showing $P_D - T_a$ curves]

**Ambient temperature $T_a$ (°C)**

- 0°C/W heat sink
- 1°C/W heat sink
- 2°C/W heat sink
- 5°C/W heat sink
- Without heat sink

**Power dissipation $P_D$ (W)**

- 0
- 25
- 50
- 75
- 100
- 125
- 150

**Supply voltage $V_{CC}$ (V)**

- 0
- 5
- 10
- 15
- 20
- 25
- 30

**Output power $P_O$ (W)**

- 0
- 5
- 10
- 15
- 20
- 25
- 30

**Power consumption $P_C$ (W)**

- 0
- 5
- 10
- 15
- 20
- 25
- 30

**Supply current $I_{CC}$ (A)**

- 0
- 5
- 10
- 15
- 20
- 25
- 30

---

2. Main characteristics

- $P_O - V_{CC}$
  - $P_O$: Output power (W)
  - $V_{CC}$: Supply voltage (V)
  - $P_{OCC}$: Power consumption (W)

  - $P_O$: Output power (1-ch.) (W)
  - $V_{CC}$: Supply voltage (V)

- $I_{CC} - P_O$
  - $I_{CC}$: Supply current (A)
  - $P_O$: Output power (1-ch.) (W)

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**Technical Information**

1. $P_D - T_a$ curves of HZIP025-P-0980

- Power dissipation $P_D$ (W)
  - Independent IC without heat sink
  - $R_{thj-c} = 1.1°C/\text{W}$
  - $R_{thj-a} = 31.1°C/\text{W}$

- Ambient temperature $T_a$ (°C)
  - 0°C/W heat sink
  - 1°C/W heat sink
  - 2°C/W heat sink
  - 5°C/W heat sink
  - Without heat sink

---

2. Main characteristics

- $P_O - V_{CC}$
  - $V_{CC}$: Supply voltage (V)
  - $P_O$: Output power (W)

- $P_{OCC}$: Power consumption (W)

- $I_{CC} - P_O$
  - $I_{CC}$: Supply current (A)
  - $P_O$: Output power (1-ch.) (W)
ICs for Audio Common Use

AN7560Z

Technical Information (continued)

2. Main characteristics (continued)

- $P_O$, THD — $V_{IN}$

- THD — $V_{IN}$

- $G_V$, $P_O$ — freq

- THD — freq

- $G_V$, THD — $V_{CC}$

- $I_{CQ}$, $I_{STB}$ — $V_{CC}$
2. Main characteristics (continued)

- **Supply voltage** $V_{CC}$ (V)
- **Output noise voltage** $V_{NO}$ (mV[<sup>rms</sup>])
  - $R_L = 4 \, \Omega$
  - $R_g = 10 \, k\Omega$

- **Ripple rejection ratio** $RR$ (dB)
  - $V_{CC}$
  - $V_{RIPPLE} = 1 \, V[<sup>rms</sup>]$
  - $f_{RIPPLE} = 1 \, kHz$

- **MT — $V_{CC}$**
  - $P_O = 1 \, W$
  - freq = 1 kHz
  - $R_L = 4 \, \Omega$
  - $R_g = 10 \, k\Omega$

- **Technical Information (continued)**
Technical Information (continued)

2. Main characteristics (continued)

**MT — V<sub>IN</sub>**

![Graph showing MT vs. V<sub>IN</sub> with V<sub>CC</sub> = 13.2 V, freq = 1 kHz, R<sub>L</sub> = 4 Ω, 400 Hz HPF, 30 kHz LPF, R<sub>g</sub> = 10 kΩ, ch.1→2,3,4 or ch.2→1,3,4]

<table>
<thead>
<tr>
<th>Input voltage V&lt;sub&gt;IN&lt;/sub&gt; (mV[rms])</th>
<th>1</th>
<th>10</th>
<th>100</th>
<th>1 000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muting effect MT (dB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CT — V<sub>CC</sub>**

![Graph showing CT vs. V<sub>CC</sub> with V<sub>CC</sub> = 13.2 V, freq = 1 kHz, R<sub>L</sub> = 4 Ω, 400 Hz HPF, 30 kHz LPF, R<sub>g</sub> = 10 kΩ, ch.1→2,3,4 or ch.2→1,3,4]

<table>
<thead>
<tr>
<th>Supply voltage V&lt;sub&gt;CC&lt;/sub&gt; (V)</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross-talk CT (dB)</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>70</td>
</tr>
</tbody>
</table>

**CT — V<sub>IN</sub>**

![Graph showing CT vs. V<sub>IN</sub> with V<sub>CC</sub> = 13.2 V, freq = 1 kHz, R<sub>L</sub> = 4 Ω, 400 Hz HPF, 30 kHz LPF, R<sub>g</sub> = 10 kΩ, ch.1→2,3,4 or ch.2→1,3,4]

<table>
<thead>
<tr>
<th>Input voltage V&lt;sub&gt;IN&lt;/sub&gt; (mV[rms])</th>
<th>1</th>
<th>10</th>
<th>100</th>
<th>1 000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross-talk CT (dB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MT — freq**

![Graph showing MT vs. freq with V<sub>CC</sub> = 13.2 V, freq = 1 kHz, R<sub>L</sub> = 4 Ω, 400 Hz HPF, 30 kHz LPF, R<sub>g</sub> = 10 kΩ, ch.3→1,2,4 or ch.4→1,2,3]

<table>
<thead>
<tr>
<th>Frequency freq (Hz)</th>
<th>10</th>
<th>100</th>
<th>1 000</th>
<th>10 000</th>
<th>100 000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muting effect MT (dB)</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
</tbody>
</table>

**CT — freq**

![Graph showing CT vs. freq with V<sub>CC</sub> = 13.2 V, freq = 1 kHz, R<sub>L</sub> = 4 Ω, 400 Hz HPF, 30 kHz LPF, R<sub>g</sub> = 10 kΩ, ch.3→1,2,4 or ch.4→1,2,3]

<table>
<thead>
<tr>
<th>Frequency freq (Hz)</th>
<th>10</th>
<th>100</th>
<th>1 000</th>
<th>10 000</th>
<th>100 000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross-talk CT (dB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. Main characteristics (continued)

- **CT—freq**
  - Frequency range: 10 Hz to 100 kHz
  - Cross-talk CT (dB) vs. Frequency
  - Conditions: $V_{CC} = 13.2$ V, freq = 1 kHz, $R_L = 4$ Ω, 400 Hz HPF, 30 kHz LPF, $R_g = 10$ kΩ

- **$V_{OFFSET} — V_{CC}$**
  - Output offset power supply $V_{offset}$ (V) vs. Supply voltage $V_{CC}$ (V)
  - Conditions: $V_{CC} = 13.2$ V, freq = 1 kHz

- **$I_{CQ} — V_{STB}$**
  - Quiescent circuit current $I_{CQ}$ (A) vs. Standby circuit voltage $V_{STB}$ (V)
  - Conditions: $V_{CC} = 13.2$ V

- **MT—$V_{MUTE}$**
  - Muting effect MT (dB) vs. Mute voltage $V_{MUTE}$ (V)
  - Conditions: $V_{CC} = 13.2$ V, freq = 1 kHz, $R_L = 4$ Ω, 400 Hz HPF, 30 kHz LPF, $R_g = 10$ kΩ
3. Printed circuit board layout example

- ICs for Audio Common Use AN7560Z

- Technical Information (continued)
Application Circuit Example

- 20 kΩ
- 10 kΩ
- 10 kΩ
- 10 kΩ
- 1 Resistors
- 1 μF
- 1 μF
- 1 μF
- 1 μF
- 33 μF
- 100 kΩ
- 100 kΩ
- 100 kΩ
- 100 kΩ
- 2200 μF
- 5 V
- 0 V
- VCC

- ch.1 Input
- ch.2 Input
- ch.3 Input
- ch.4 Input

- Beep Input
- Muting
- Standby