

# AN7561Z

## BTL output power IC for car audio

### ■ Overview

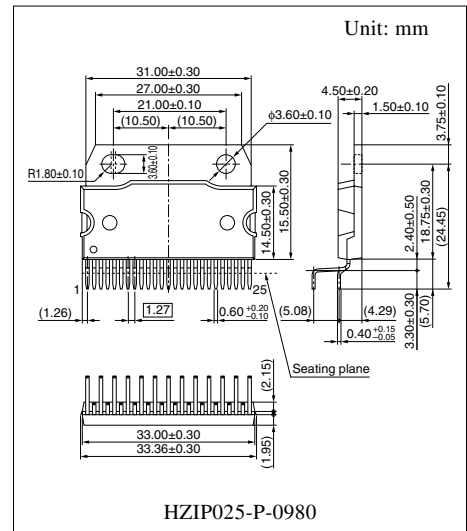
The AN7561Z is an audio power IC developed as a car audio output (35 W × 4-ch). CR to stop oscillation is built in between the output pin and GND so that a space saving of set is possible. Also, it is incorporating a perfect muting circuit which does not make a shock noise so that a shock noise design in the set transitional state can be made easily when used together with its standby function. In addition, it is incorporating various protective circuits to protect the IC from destruction by GND-open earth short-circuiting and power supply surge which are the important subject of power IC, and the IC will largely contribute to a high reliability design of equipment.

### ■ Features

- Pin arrangement which does not allow the input/output patterns to intersect each other so that it is possible to make a pattern design on a one-sided printed circuit board.
- Incorporating various protection circuits (thermal protection, short-circuit to  $V_{CC}$ , short-circuit to  $V_{CC}$  in  $V_{CC}$ -opened, short-circuit to GND, short-circuit to GND in GND-opened, over voltage, power supply surge, and ASO protection, etc.)
- Incorporating standby function (shock noise-free at STB-on/off)
- Incorporating standby function (shock noise-free at Mute-on/off)
- External components reduction
- Provided with beep sound input pin
- Equipped with auxiliary sound input pin
- Inverted pin layout of AN7560Z on right and left pins

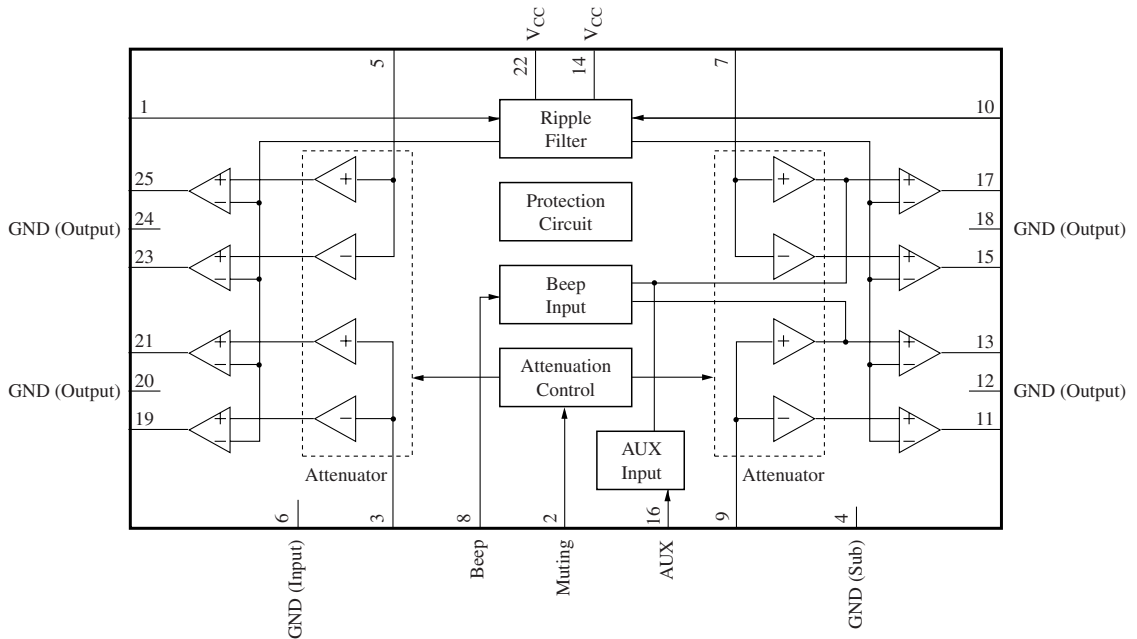
### ■ Applications

- Car stereo, miniature audio component, karaoke and other audio equipment.



Note) The package of this product will be changed to lead-free type (HZIP025-P-0980B). See the new package dimensions section later of this datasheet.

## ■ Block Diagram



## ■ Pin Descriptions

| Pin No. | Description       | Pin No. | Description             |
|---------|-------------------|---------|-------------------------|
| 1       | Ripple filter     | 14      | Supply voltage $V_{CC}$ |
| 2       | Mute              | 15      | ch.2 – output           |
| 3       | ch.3 input        | 16      | AUX input               |
| 4       | GND (Sub)         | 17      | ch.2 + output           |
| 5       | ch.4 input        | 18      | GND (ch.2 output)       |
| 6       | GND (Input)       | 19      | ch.3 – output           |
| 7       | ch.2 input        | 20      | GND (ch.3 output)       |
| 8       | Beep input        | 21      | ch.3 + output           |
| 9       | ch.1 input        | 22      | Supply voltage $V_{CC}$ |
| 10      | Standby           | 23.     | ch.4 – output           |
| 11      | ch.1 – output     | 24      | GND (ch.4 output)       |
| 12      | GND (ch.1 output) | 25      | ch.4 + output           |
| 13      | ch.1 + output     |         |                         |

Note) The output pin requires no capacitor and resistor for oscillation prevention.

If those are required for countermeasure against noise, be sure to use after confirmation.

### ■ Absolute Maximum Ratings

| Parameter                        | Symbol      | Rating      | Unit |
|----------------------------------|-------------|-------------|------|
| Supply voltage *2                | $V_{CC}$    | 25          | V    |
| Peak power-supply-voltage *3     | $V_{Surge}$ | 65          | V    |
| Supply current                   | $I_{CC}$    | 12          | A    |
| Power dissipation *4             | $P_D$       | 59          | W    |
| Operating ambient temperature *1 | $T_{opr}$   | -30 to +85  | °C   |
| Storage temperature *1           | $T_{stg}$   | -55 to +150 | °C   |

Note) \*1 :  $T_a = 25\text{ °C}$  except power dissipation, operating ambient temperature and storage temperature.

\*2 : Without signal

\*3 : Time = 0.2 s

\*4 :  $T_a = 85\text{ °C}$

### ■ Recommended Operating Range

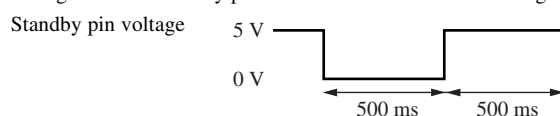
| Parameter      | Symbol   | Range       | Unit |
|----------------|----------|-------------|------|
| Supply voltage | $V_{CC}$ | 8.0 to 18.0 | V    |

### ■ Electrical Characteristics at $V_{CC} = 13.2\text{ V}$ , freq = 1 kHz, $T_a = 25\text{ °C}$

| Parameter                   | Symbol    | Conditions  | Min  | Typ  | Max | Unit          |
|-----------------------------|-----------|---|------|------|-----|---------------|
| Quiescent circuit current   | $I_{CQ}$  | $R_G = 10\text{ k}\Omega$ , $R_L = 4\text{ }\Omega$   | —    | 300  | 450 | mA            |
| Standby current             | $I_{STB}$ | $R_G = 10\text{ k}\Omega$ , $R_L = 4\text{ }\Omega$   | —    | 1    | 10  | $\mu\text{A}$ |
| Output noise voltage *1     | $V_{NO}$  | $R_G = 10\text{ k}\Omega$ , $R_L = 4\text{ }\Omega$   | —    | 0.15 | 0.5 | mV[rms]       |
| Voltage gain                | $G_V$     | $V_{IN} = 40\text{ mV}$ , $R_L = 4\text{ }\Omega$   | 32   | 34   | 36  | dB            |
| Total harmonic distortion 1 | THD1      | $V_{IN} = 40\text{ mV}$ , $R_L = 4\text{ }\Omega$   | —    | 0.05 | 0.2 | %             |
| Maximum output power        | $P_O$     | THD = 10%, $R_L = 4\text{ }\Omega$  | 16.0 | 19.5 | —   | W             |
| Ripple rejection ratio *1   | RR        | $R_L = 4\text{ }\Omega$ , $R_G = 10\text{ k}\Omega$ ,<br>$V_R = 1\text{ V[rms]}$ , fr = 1 kHz                               | 60   | 68   | —   | dB            |
| Channel balance             | CB        | $V_{IN} = 40\text{ mV}$ , $R_L = 4\text{ }\Omega$   | —    | 0    | 1   | dB            |
| Crosstalk                   | CT        | $V_{IN} = 40\text{ mV}$ , $R_L = 4\text{ }\Omega$ ,<br>$R_G = 10\text{ k}\Omega$  | 60   | 70   | —   | dB            |
| Output offset voltage       | $V_{OFF}$ | $R_G = 10\text{ k}\Omega$ , $R_L = 4\text{ }\Omega$   | -250 | 0    | 250 | mV            |
| Muting effect *1            | MT        | $V_{IN} = 40\text{ mV}$ , $R_L = 4\text{ }\Omega$   | 70   | 86   | —   | dB            |
| Input impedance             | $Z_I$     | $V_{IN} = \pm 0.3\text{ V}_{DC}$  | 24   | 30   | 36  | k $\Omega$    |
| Shock noise *2              | $V_S$     | $R_L = 4\text{ }\Omega$ , $R_G = 10\text{ k}\Omega$ ,<br>$V_{MUTE} = 5\text{ V}$ , $V_{STB} = \text{On/Off}$ ,<br>50 Hz HPF | -100 | 0    | 100 | mV[p-0]       |

Note) \*1 : Use 15 Hz to 30 kHz (12 dB/OCT) band-pass filter at measurement.

\*2 : Change over the standby pin at 0V and 5V with the following time.



■ Electrical Characteristics at  $V_{CC} = 9\text{ V}$ ,  $T_a = 25\text{ °C}$  (continued)

| Parameter                   | Symbol            | Conditions  | Min | Typ | Max | Unit |
|-----------------------------|-------------------|---|-----|-----|-----|------|
| Total harmonic distortion 2 | THD2              | $V_{IN} = 20\text{ mV}$ , $f_{IN} = 20\text{ kHz}$ ,<br>$R_G = 10\ \Omega$ , $R_L = \infty$ | —   | 0.1 | 0.5 | %    |
| Mute-on threshold voltage   | MT <sub>ON</sub>  | $V_{IN} = 40\text{ mV}$ , $R_L = 4\ \Omega$   | 4   | —   | —   | V    |
| Mute-off threshold voltage  | MT <sub>OFF</sub> | $V_{IN} = 40\text{ mV}$ , $R_L = 4\ \Omega$   | —   | —   | 0.8 | V    |
| Cutoff frequency            | $f_C$             | $V_{IN} = 40\text{ mV}$ , $R_L = 4\ \Omega$<br>$G_V = -1\text{ dB}$ (0 dB: 1 kHz)           | 20  | 40  | —   | kHz  |

- Design reference data at  $V_{CC} = 13.2\text{ V}$ ,  $f = 1\text{ kHz}$ , measuring bandwidth 15 Hz to 30 kHz (12 dB/OCT) filter is used

Note) The characteristic values below are theoretical values for designing and not guaranteed.

| Parameter             | Symbol             | Conditions   | Min | Typ | Max | Unit |
|-----------------------|--------------------|--|-----|-----|-----|------|
| Maximum output power  | P <sub>Omax</sub>  | max. power, $R_L = 4\ \Omega$  | —   | 28  | —   | W    |
| Maximum output power  | P <sub>O2</sub>    | $V_{CC} = 14.4\text{ V}$ , THD = 10%,<br>$R_L = 4\ \Omega$   | —   | 21  | —   | W    |
| Maximum output power  | P <sub>Omax2</sub> | $V_{CC} = 14.4\text{ V}$ , max. power,<br>$R_L = 4\ \Omega$  | —   | 34  | —   | W    |
| Power band            | $f_{PL}$           | $V_{CC} = 14.4\text{ V}$ , THD = 1%,<br>$R_L = 4\ \Omega$ ,<br>$P_{OL} = -3\text{ dB}$ (1 kHz: 0 dB) | —   | 10  | —   | Hz   |
| Power band            | $f_{PH}$           | $V_{CC} = 14.4\text{ V}$ , THD = 1%,<br>$R_L = 4\ \Omega$ ,<br>$P_{OH} = -3\text{ dB}$ (1 kHz: 0 dB) | —   | 18  | —   | kHz  |
| STB threshold voltage | V <sub>STB1</sub>  | $R_G = 10\text{ k}\Omega$ , $R_L = 4\ \Omega$ ,<br>STB→ACT   | —   | 2.2 | —   | V    |
| STB threshold voltage | V <sub>STB2</sub>  | $R_G = 10\text{ k}\Omega$ , $R_L = 4\ \Omega$ ,<br>ACT→STB   | —   | 1.5 | —   | V    |

■ Terminal Equivalent Circuits

| Pin No. | Equivalent circuit | Description   | DC Voltage    |
|---------|--------------------|---|---------------|
| 1       |                    | Ripple filter pin:<br>Output current from 3 mA to 10mA                        | 13 V          |
| 2       |                    | Mute pin:<br>Mute switchover pin<br>Threshold voltage about 2.1 V             | 0 V           |
| 3       |                    | ch.3 input pin:<br>ch.3 input signal application pin<br>Input impedance 30 kΩ | 0 mV to 10 mV |
| 4       | —                  | GND (circuit board): Circuit board  | 0 V           |
| 5       |                    | ch.4 input pin:<br>ch.4 input signal application pin<br>Input impedance 30 kΩ | 0 mV to 10 mV |

■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description  | Voltage       |
|---------|--------------------|--|---------------|
| 6       | —                  | GND (input): Grounding pin for input   | 0 V           |
| 7       |                    | ch.2 input pin:<br>ch.2 input signal application pin<br>Input impedance 30 kΩ    | 0 mV to 10 mV |
| 8       |                    | Beep sound input pin:<br>Beep sound signal input pin<br>Input impedance 15 kΩ    | 0 V           |
| 9       |                    | ch.1 input pin:<br>ch.1 input signal application pin<br>Input impedance 30 kΩ    | 0 mV to 10 mV |
| 10      |                    | Standby control pin:<br>Standby switch over pin<br>Threshold voltage about 2.1 V | 5 V           |

■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description  | Voltage |
|---------|--------------------|--|---------|
| 11      |                    | ch.1 output pin (-):<br>ch.1 negative phase output pin   | 6.3 V   |
| 12      | —                  | GND (output):<br>Grounding pin for ch.1 output           | 0 V     |
| 13      |                    | ch.1 output pin (+):<br>ch.1 positive phase output pin   | 6.3 V   |
| 14      | —                  | Power supply voltage pin:<br>Power supply connection pin | 13.2 V  |
| 15      |                    | ch.2 output pin (-):<br>ch.2 negative phase output pin   | 6.3 V   |
| 16      |                    | AUX input pin:<br>Input impedance 10.6 kΩ                | 6.3 V   |

### ■ Terminal Equivalent Circuits (continued)

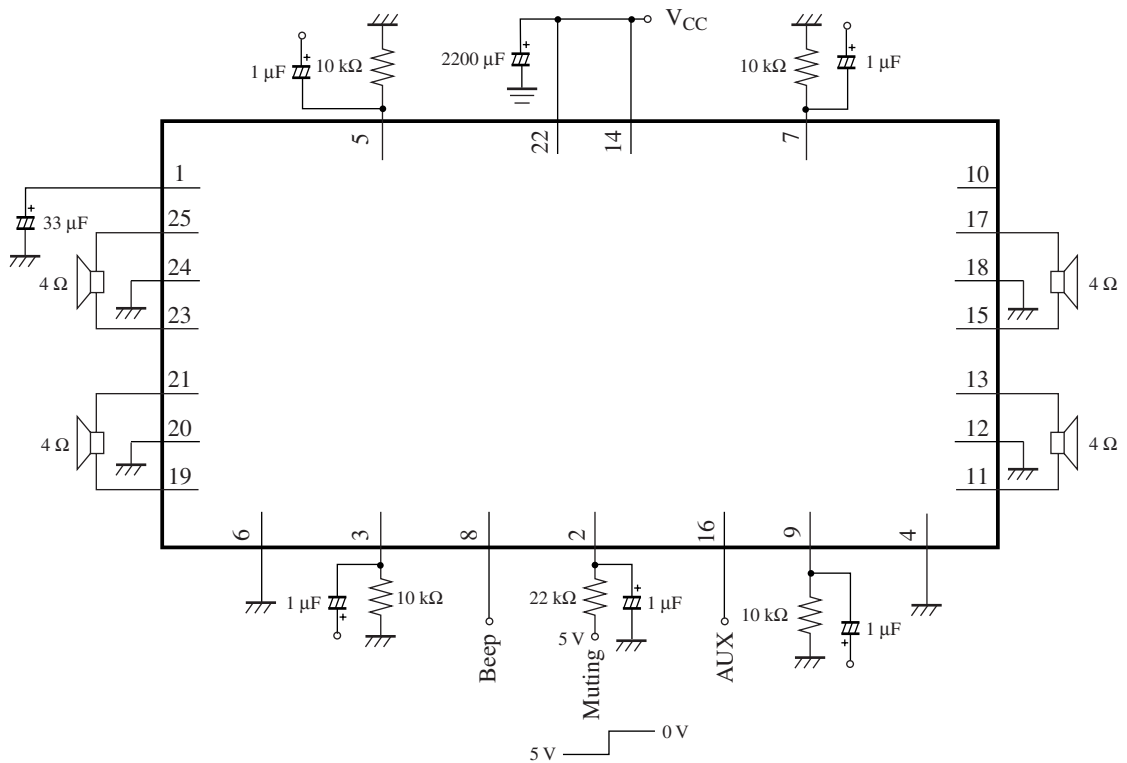
| Pin No. | Equivalent circuit | Description  | Voltage |
|---------|--------------------|--|---------|
| 17      |                    | ch.2 output pin (+):<br>ch.2 positive phase output pin   | 6.3 V   |
| 18      | —                  | GND (output):<br>Grounding pin for ch.2 output           | 0 V     |
| 19      |                    | ch.3 output pin (-):<br>ch.3 negative phase output pin   | 6.3 V   |
| 20      | —                  | GND (output):<br>Grounding pin for ch.3 output           | 0 V     |
| 21      |                    | ch.3 output pin (+):<br>ch.3 positive phase output pin   | 6.3 V   |
| 22      | —                  | Power supply voltage pin:<br>Power supply connection pin | 13.2 V  |



■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description  | Voltage |
|---------|--------------------|--|---------|
| 23      |                    | ch.4 output pin (-):<br>ch.4 negative phase output pin | 6.3 V   |
| 24      | —                  | GND (output):<br>Grounding pin for ch.4 output         | 0 V     |
| 25      |                    | ch.4 output pin (+):<br>ch.4 positive phase output pin | 6.3 V   |

## ■ Application Circuit Example



## ■ Usage notes

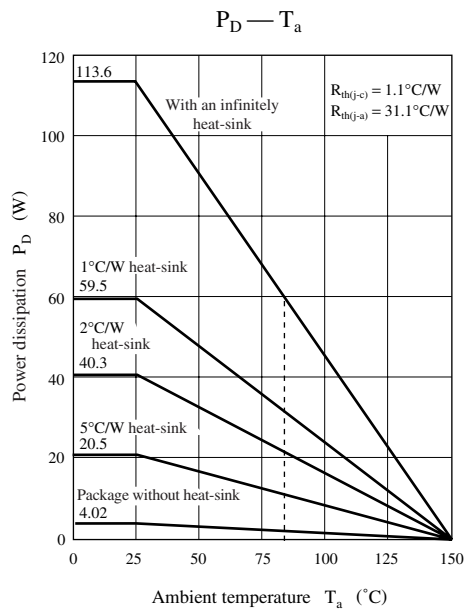
1. Be sure to use the circuit with an external heat-sink and fix the external heat-sink on chassis when using it.
2. Connect the heat radiating fin to GND potential.
3. This IC has built-in protection circuit against short-circuit to  $V_{CC}$ , short-circuit to GND and ASO. However avoid short-circuit to  $V_{CC}$ , short-circuit to GND and short-circuit of load.
4. The thermal protection circuit operates at  $T_j =$  about  $150\text{ }^{\circ}\text{C}$  but it automatically returns to the normal operation when the temperature decreases.
5. The over voltage protection circuit operates at  $V_{CC} =$  about  $20\text{ V}$ .
6. Be especially careful to heat radiation design when used at an increased  $V_{CC}$ .
7. Connect the beep sound input pin to GND when the beep sound function is not used.
8. Do not lower the beep sound input pin below  $-0.3\text{ V}$ .
9. Keep AUX input pin in open state when AUX function is not used.
10. Connect only GND pin (signal source) to the signal GND of the amplifier in previous stage.

### • There is a possibility of device destruction under the following conditions;

1. If the power supply pin and GND pin are connected in reverse to the power supply.
2. If the power supply pin and GND pin are in open state and the power supply is connected across the output pins.
3. If the output pin is grounded when GND pin is open.
4. If more than three output pins are grounded to the earth at a time with more than  $1.3\text{ }\Omega$  short-circuiting resistor with which the protection circuit does not operate.
5. If plus and minus output pins are short circuited to the supply line at a time with more than  $1\text{ }\Omega$  short-circuiting resistor with which the protection circuit does not operate.
6. If the RF pin and the output pin are short circuited and short-circuited to the earth.

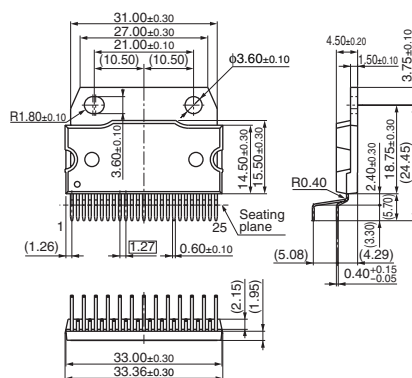
■ Technical Information

- HZP025-P-0980 package power dissipation



■ New Package Dimensions (Unit: mm)

- HZIP025-P-0980B (Lead-free package)



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