TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

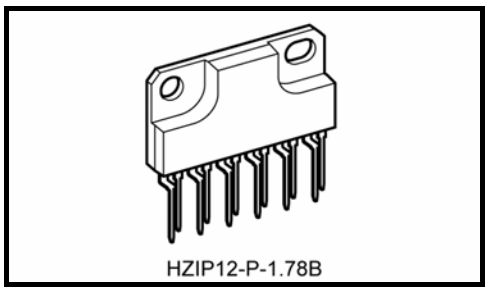
# TA8258HQ

## Dual Audio Power Amplifier

The TA8258HQ is dual audio power amplifier for consumer applications.

This IC provides an output power of 20 watts per channel (at $V_{CC}$ = 37 V, f = 1kHz, THD = 10%, $R_L$ = 8 Ω).

It is suitable for power amplifier of music center.



HZIP12-P-1.78B

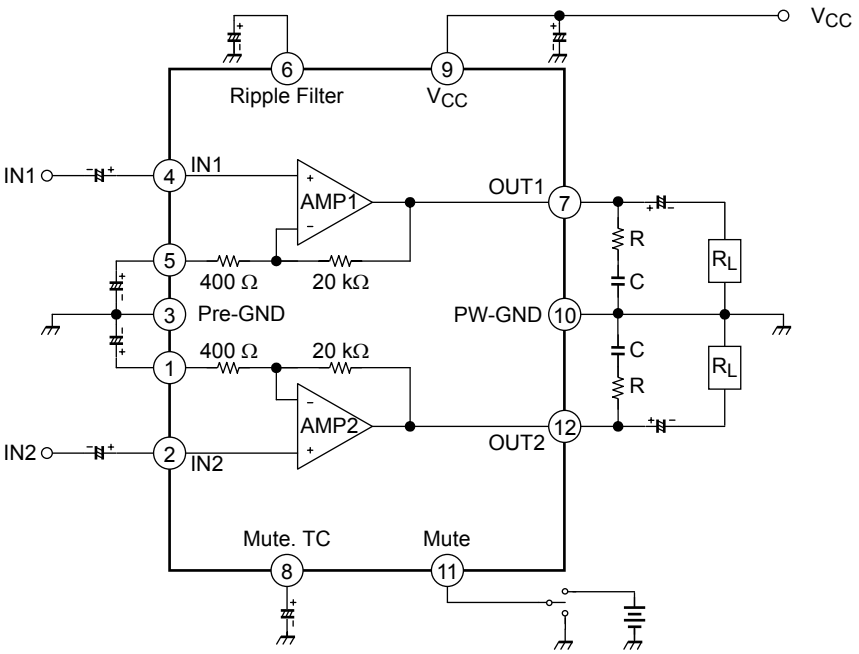
Weight: 4.04 g (typ.)

## Features

- High output power: $P_{out}$ = 20 W/channel (Typ.)
  ($V_{CC}$ = 37 V, $R_L$ = 8 Ω, f = 1 kHz, THD = 10%)
- Low noise: $V_{no}$ = 0.14 mVrms (Typ.)
  ($V_{CC}$ = 37 V, $R_L$ = 8 Ω, $G_V$ = 34dB, $R_g$ = 10 kΩ, BW = 20 Hz~20 kHz)
- Very few external parts.
- Built in audio muting circuit.
- Built in thermal shut down protector circuit.
- Built in output shifted to GND protection circuit. (AC short)
- Available for using same PCB layout with: TA8200AH, TA8211AH, TA8216H
- Operation supply voltage range (Ta = 25°C)
  : $V_{CC\ (opr)}$ = 15~42 V

The TA8258HQ is plated with lead-free lead finishes, but the silicon pellet is attached to a heatsink with lead-containing solder paste.

## Block Diagram




## Application Information

### 1. Voltage gain

The closed loop voltage gain is determined by $R_1$, $R_2$.

$$G_V = 20\log\frac{R_1+R2}{R_2}(\text{dB})$$

$$= 20\log\frac{20\,\text{k}\Omega + 400\,\Omega}{400\,\Omega}$$

$$= 34\ (\text{dB})$$

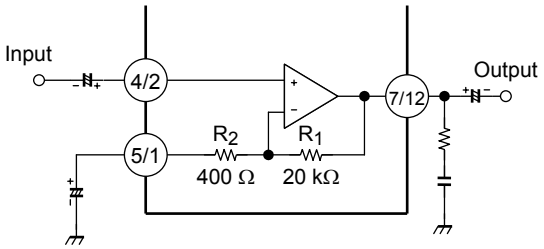



**Figure 1**

$$G_V = 20\log\frac{R_1 + R_2 + R_3}{R_2 + R_3}(\text{dB})$$

When $R_3 = 220\ \Omega$
$G_V \simeq 30$ (dB)
is given.

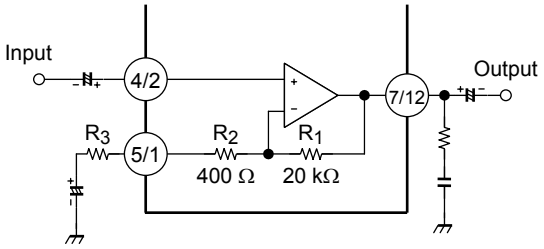



**Figure 2**

Toshiba has confirmed that the $G_V$ (min) is approximately 28 (dB) on a regular printed circuit board. However, if the value of $R_2 + R_3$ is larger, the feedback voltage increases and oscillation will start. Determine the value of $R_2 + R_3$ to ensure proper startup behavior under actual usage conditions.

## 2. Muting

This product has an excellent muting system.

(1) Audio muting

This IC is possible to make audio muting operation by using 11 pin muting terminal.
Figure 3 shows the equivalent circuit in the muting circuit.
By reducing the voltage of 11 pin to 2.8 V or less, $Q_1$ will be ON.
Also the base voltage of $Q_2$ in the differential circuit that has $Q_2$ and $Q_3$ will be down.
When $Q_2$ is OFF, $I_2$ and $I_5$ dummy circuits will be operated, and it will shut down the input.
However, the bias circuit is operating after muting, and it takes power supply current at no signal.
8 pin is the capacitor terminal for reducing the pop noise, and it can make the time constant longer by inserting the capacitor externally. If 11 pin is not used, connect 11 pin and 8 pin, then set the voltage abode 4 V.

(2) IC internal muting at $V_{CC}$ OFF

When $V_{CC}$ = 8 V or less at $V_{CC}$ off, the detection circuit at $V_{CC}$ off is operated. And the base voltage of $Q_1$ is reduced and the muting is operated in IC.

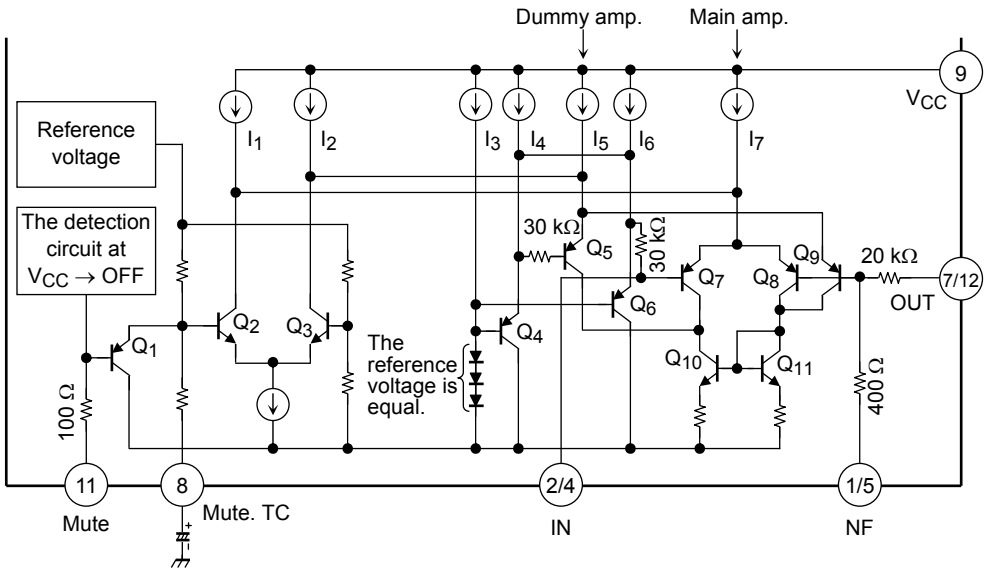



**Figure 3**

## 3. The Mounting Place of an Integrated Circuit

This IC cannot withstand the strong electromagnetic fields generated by a CRT. These are likely to cause the device to exhibit malfunctions such as leakage.
Please ensure that the IC is kept away from CRT.

## 4. Preventive Measures Against Oscillation

To prevent oscillation, it is advisable to use capacitors made of polyester film, which have low temperature and frequency fluctuation characteristics, as C.
The resistance R in series with C performs phase correction at high frequencies and improves the oscillation allowance.

(1) Capacitor rating and type
(2) PCB layout

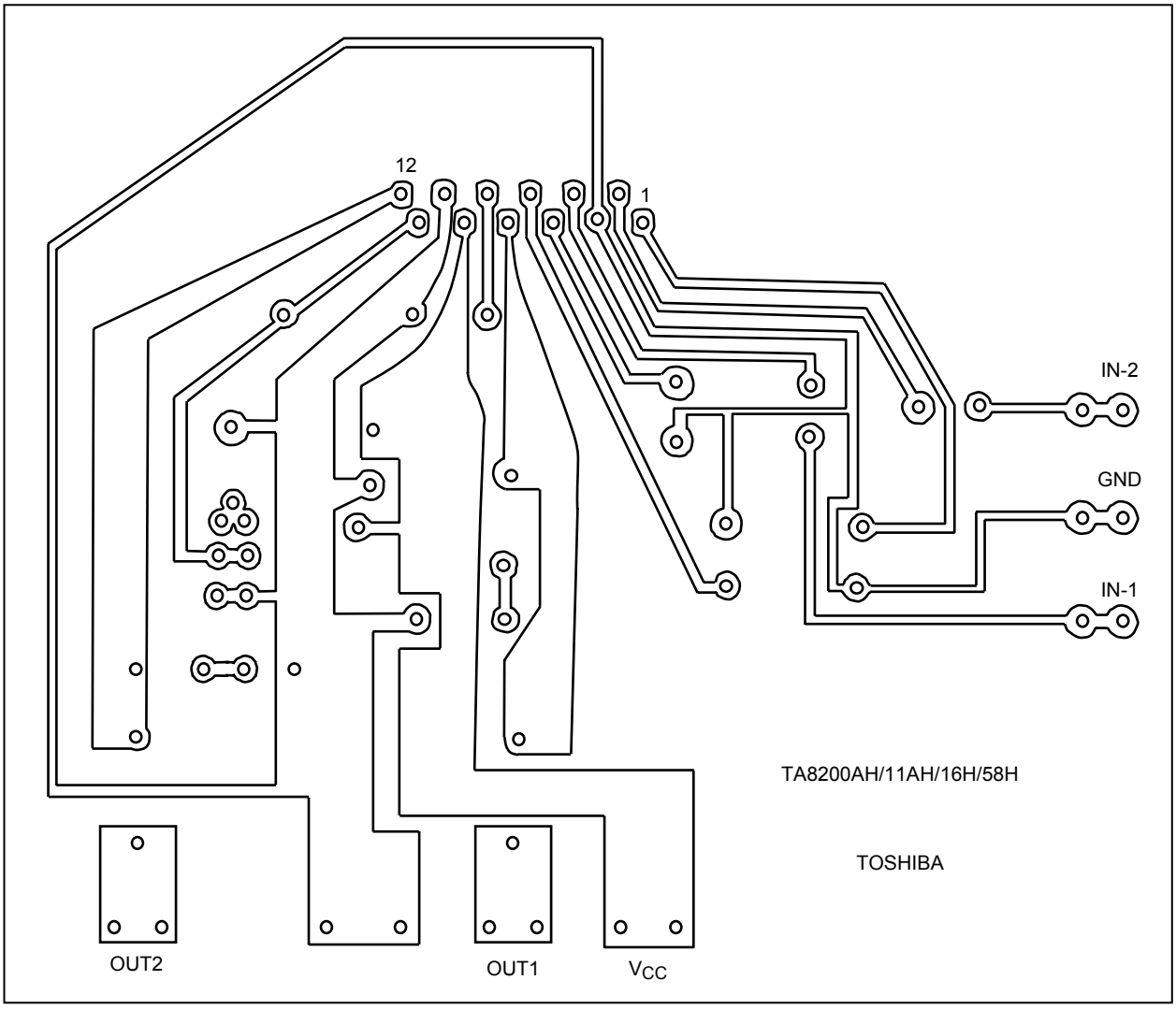
Note 1: Since the oscillation allowance varies according to the PCB layout, it is recommended that a standard Toshiba PCB be used as a reference for design.

### 5. Heat-sink

Be aware of the heat-sink capacity.
Use a heat-sink that has high heat conduction.

Note 2: Please connected a Heat-sink to GND potential, otherwise THD may deteriorate.

**Standard PCB**




(bottom view)

## Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | 50 | V |
| Output current (Peak/ch) | $I_{O\ (peak)}$ | 3.5 | A |
| Power dissipation | $P_D$ (Note 3) | 25 | W |
| Operation temperature | $T_{opr}$ | −20 to 75 | °C |
| Storage temperature | $T_{stg}$ | −55 to 150 | °C |

Note 3: Derated above Ta = 25°C in the proportion of 200 mW/°C.

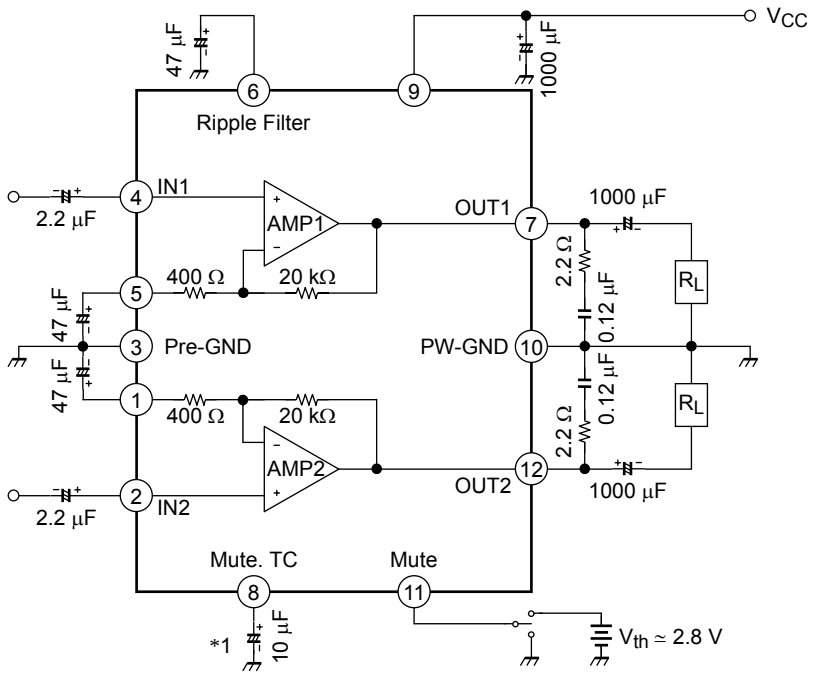
## Electrical Characteristics
## (unless otherwise specified $V_{CC}$ = 37 V, $R_L$ = 8 Ω, $R_g$ = 600 Ω, f = 1 kHz, Ta = 25°C)

| Characteristics | Symbol | Test Circuit | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Quiescent current | $I_{CCQ}$ | — | $V_{in}$ = 0 | — | 75 | 130 | mA |
| Output power | $P_{out}$ (1) | — | THD = 10% | 17 | 20 | — | W |
| | $P_{out}$ (2) | — | THD = 1% | — | 15 | — | |
| Total harmonic distortion | THD | — | $P_{out}$ = 2 W | — | 0.05 | 0.2 | % |
| Voltage gain | $G_V$ | — | $V_{out}$ = 0.775 Vrms (0dBm) | 32.5 | 34.0 | 35.5 | dB |
| Input resistance | $R_{IN}$ | — | — | — | 30 | — | kΩ |
| Ripple rejection ratio | R.R. | — | $f_{ripple}$ = 100 Hz<br>$V_{ripple}$ = 0.775 Vrms (0dBm) | −48 | −60 | — | dB |
| Output noise voltage | $V_{no}$ | — | Rg = 10 kΩ,<br>BW = 20 Hz~20 kHz | — | 0.14 | 0.3 | mVrms |
| Cross talk | C.T. | — | Rg = 10 kΩ,<br>$V_{out}$ = 0.775 Vrms (0dBm) | −50 | −60 | — | dB |
| Mute on voltage | Mute-on | — | Mute on | GND | — | 1.4 | V |
| Mute off voltage | Mute-off | — | Mute off | 3.7 | — | 10 | V |
| Mute ATT | ATT | — | $V_{out}$ = 0.775 Vrms → Mute | −50 | −60 | — | dB |

## Typ. DC Voltage of Each Terminal ($V_{CC}$ = 28 V, Ta = 25°C)

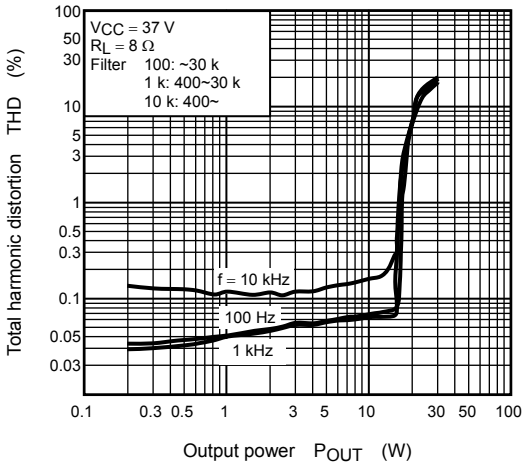
| Terminal No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DC voltage (V) | 2.5 | 2.8 | GND | 2.8 | 2.5 | 12.5 | 19.4 | 5.1 | $V_{CC}$ | GND | 4.8 | 19.4 |

## Test Circuit

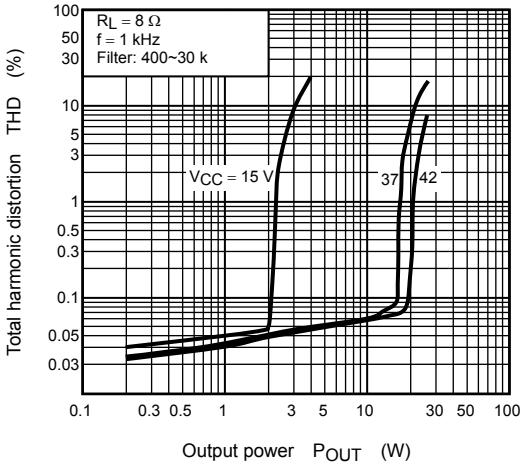



*1: The capacitor for reducing POP noise at mute ON.

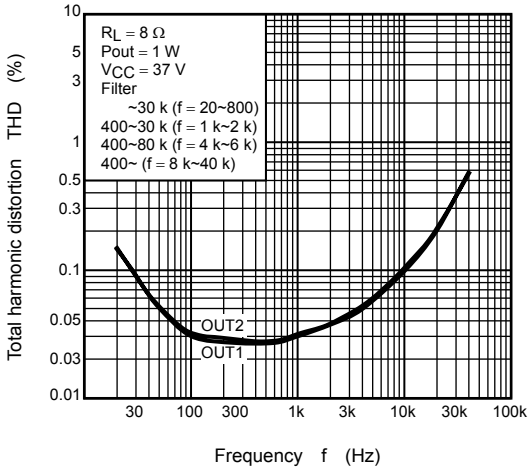
THD – Pout



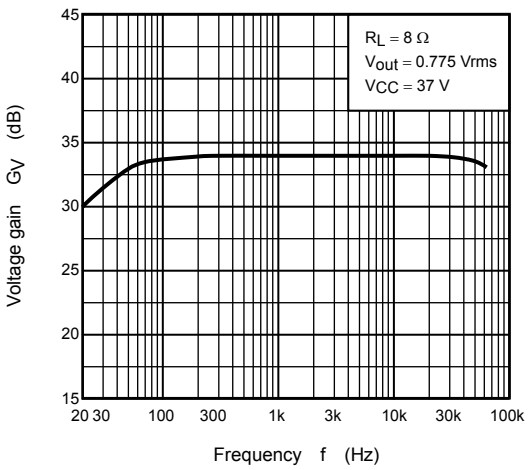

THD – Pout



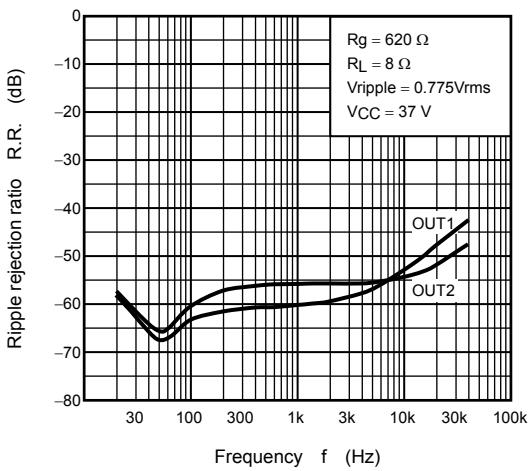

THD – f



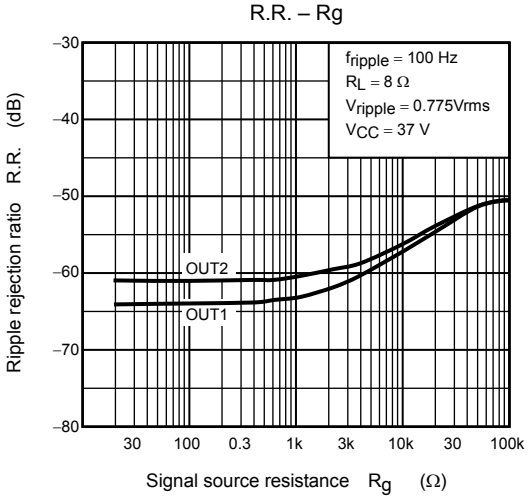

$G_V$ – f



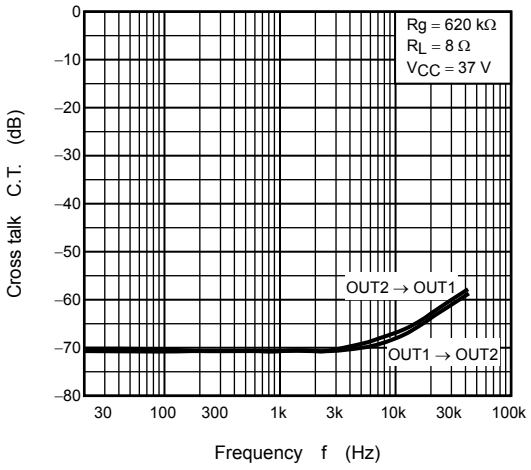

R.R. – f



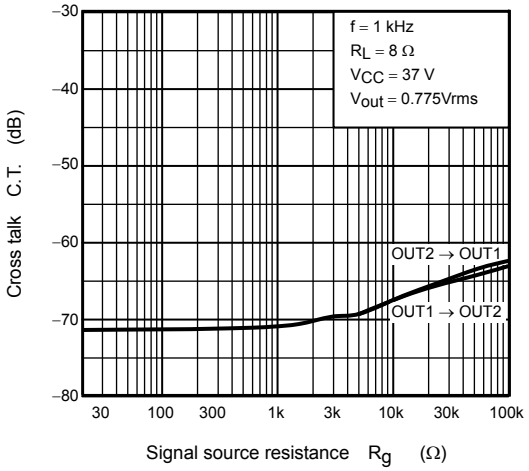

R.R. – Rg



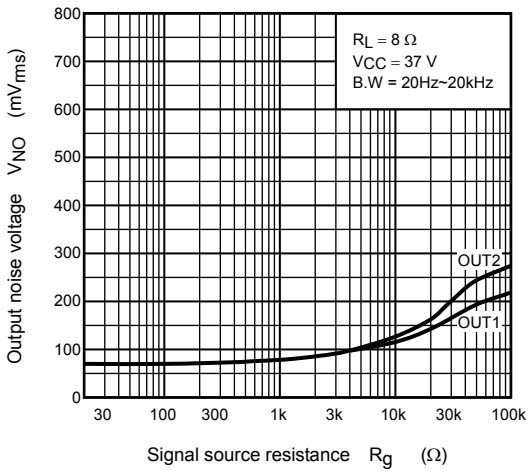
C.T. – f



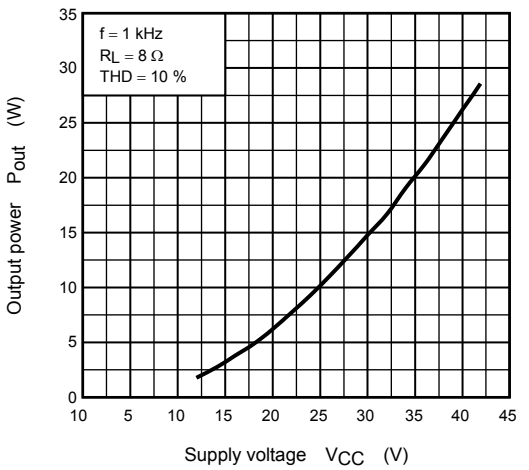

C.T. – Rg



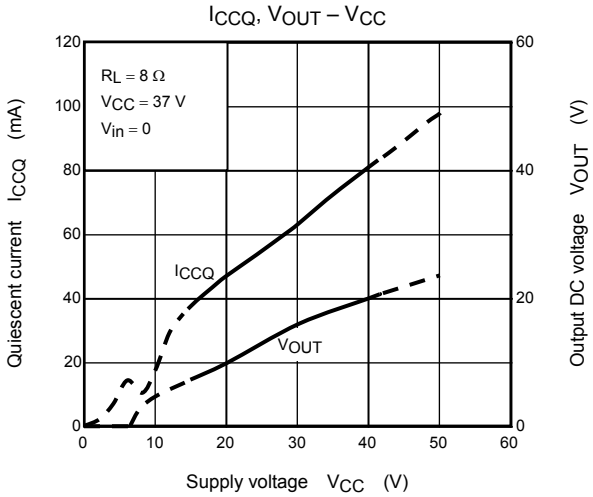

$V_{no}$ – Rg



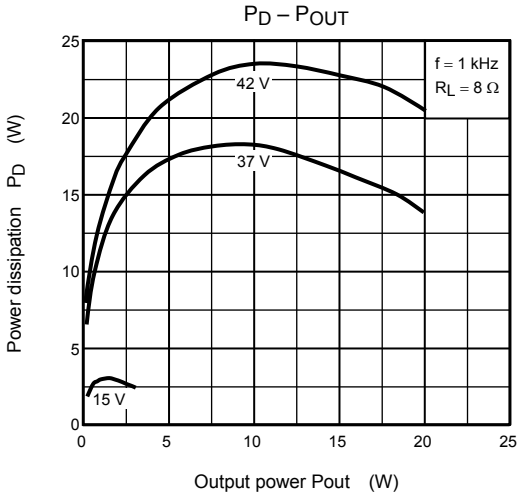

$P_{out}$ – $V_{CC}$



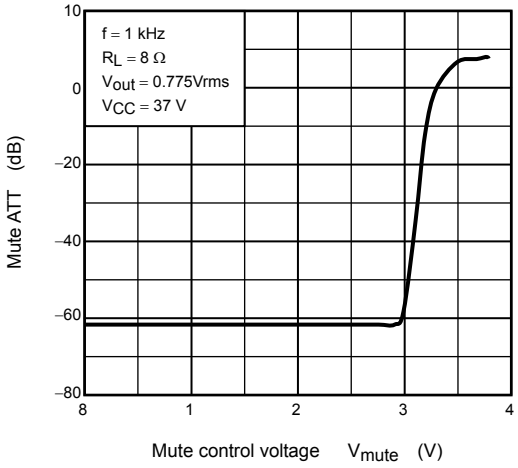

$I_{CCQ}$, $V_{OUT}$ – $V_{CC}$



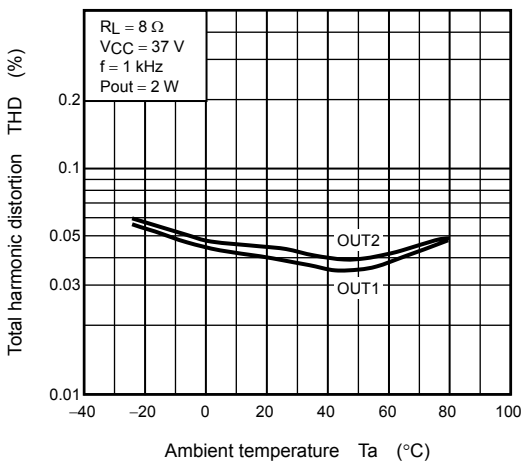

$P_D$ – $P_{OUT}$



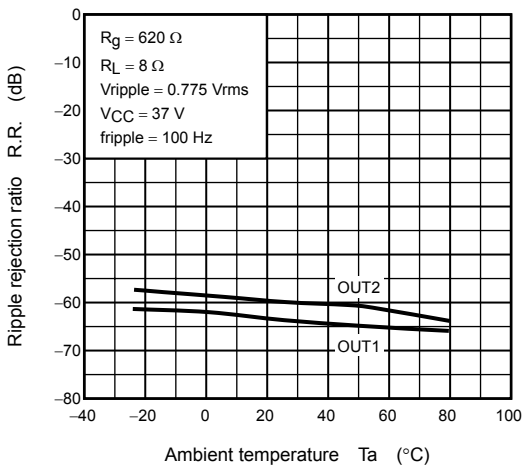
ATT – $V_{mute}$



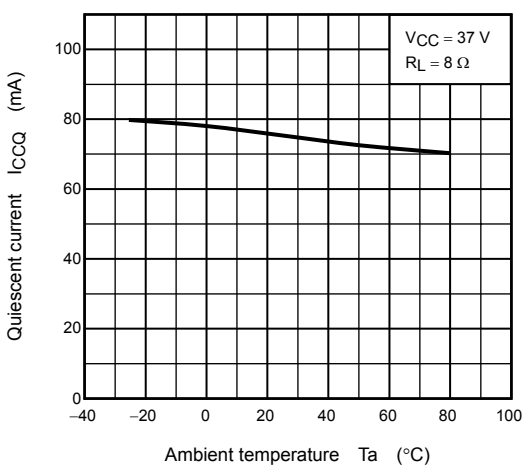

THD – Ta



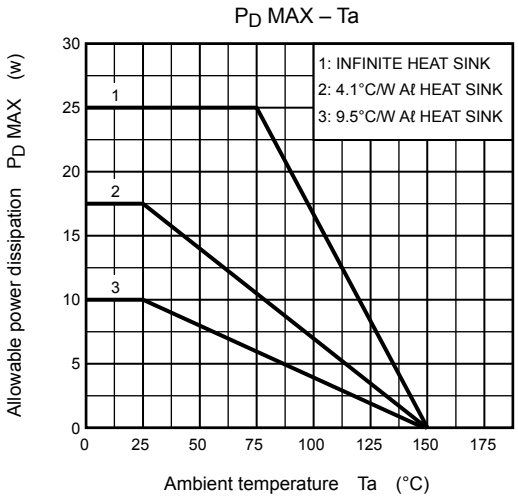

R.R. – Ta




$I_{CCQ}$ – Ta

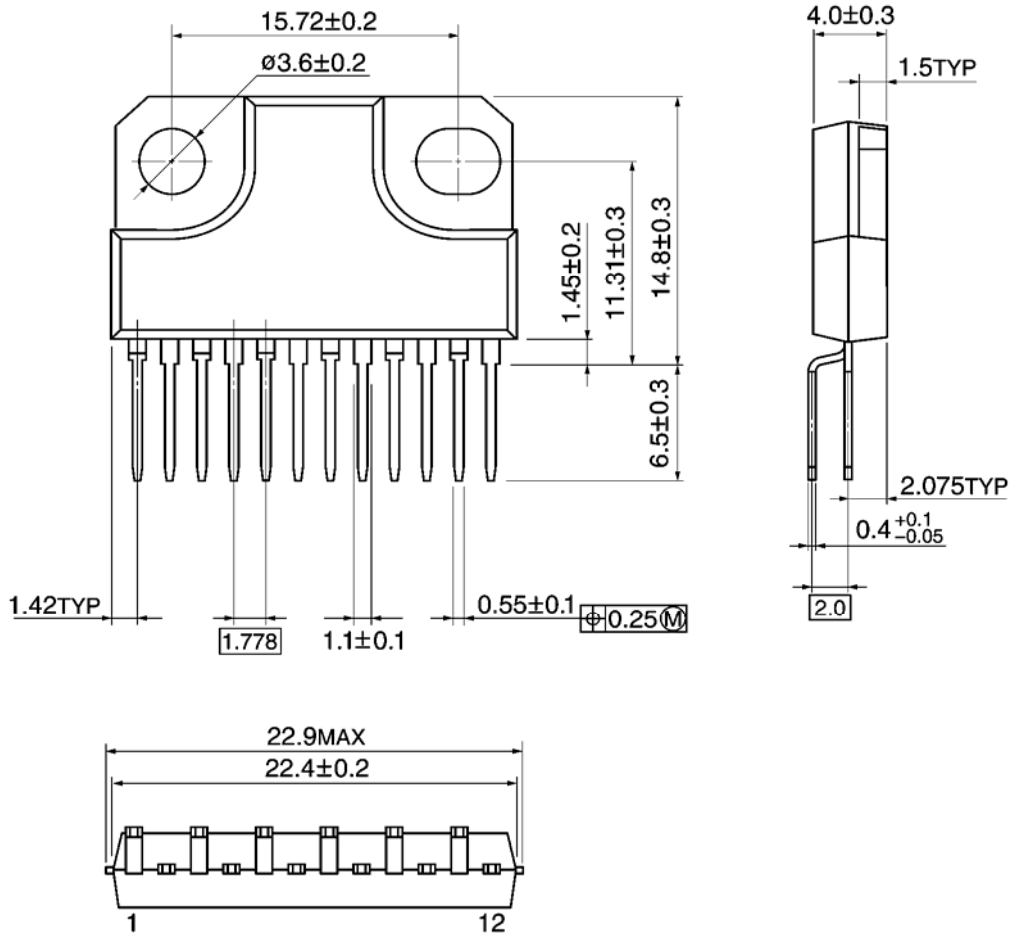



$P_D$ MAX – Ta



## Package Dimensions

HZIP12-P-1.78B Unit: mm




Weight: 4.04 g (typ.)

- **Strong Electrical and Magnetic Fields**

Devices exposed to strong magnetic fields can undergo a polarization phenomenon in their plastic material, or within the chip, which gives rise to abnormal symptoms such as impedance changes or increased leakage current. Failures have been reported in LSIs mounted near malfunctioning deflection yokes in TV sets. In such cases the device's installation location must be changed or the device must be shielded against the electrical or magnetic field. Shielding against magnetism is especially necessary for devices used in an alternating magnetic field because of the electromotive forces generated in this type of environment.

- Use an appropriate power supply fuse to ensure that a large current does not continuously flow in case of over current and/or IC failure. The IC will fully break down when used under conditions that exceed its absolute maximum ratings, when the wiring is routed improperly or when an abnormal pulse noise occurs from the wiring or load, causing a large current to continuously flow and the breakdown can lead smoke or ignition. To minimize the effects of the flow of a large current in case of breakdown, appropriate settings, such as fuse capacity, fusing time and insertion circuit location, are required.
- If your design includes an inductive load such as a motor coil, incorporate a protection circuit into the design to prevent device malfunction or breakdown caused by the current resulting from the inrush current at power ON or the negative current resulting from the back electromotive force at power OFF. For details on how to connect a protection circuit such as a current limiting resistor or back electromotive force adsorption diode, refer to individual IC datasheets or the IC databook. IC breakdown may cause injury, smoke or ignition.
- Use a stable power supply with ICs with built-in protection functions. If the power supply is unstable, the protection function may not operate, causing IC breakdown. IC breakdown may cause injury, smoke or ignition.
- Carefully select external components (such as inputs and negative feedback capacitors) and load components (such as speakers), for example, power amp and regulator. If there is a large amount of leakage current such as input or negative feedback condenser, the IC output DC voltage will increase. If this output voltage is connected to a speaker with low input withstand voltage, overcurrent or IC failure can cause smoke or ignition. (The over current can cause smoke or ignition from the IC itself.) In particular, please pay attention when using a Bridge Tied Load (BTL) connection type IC that inputs output DC voltage to a speaker directly.
- Over current Protection Circuit
  Over current protection circuits (referred to as current limiter circuits) do not necessarily protect ICs under all circumstances. If the Over current protection circuits operate against the over current, clear the over current status immediately. Depending on the method of use and usage conditions, such as exceeding absolute maximum ratings can cause the over current protection circuit to not operate properly or IC breakdown before operation. In addition, depending on the method of use and usage conditions, if over current continues to flow for a long time after operation, the IC may generate heat resulting in breakdown.
- Thermal Shutdown Circuit
  Thermal shutdown circuits do not necessarily protect ICs under all circumstances. If the Thermal shutdown circuits operate against the over temperature, clear the heat generation status immediately. Depending on the method of use and usage conditions, such as exceeding absolute maximum ratings can cause the thermal shutdown circuit to not operate properly or IC breakdown before operation.
- Heat Radiation Design
  When using an IC with large current flow such as power amp, regulator or driver, please design the device so that heat is appropriately radiated, not to exceed the specified junction temperature (Tj) at any time and condition. These ICs generate heat even during normal use. An inadequate IC heat radiation design can lead to decrease in IC life, deterioration of IC characteristics or IC breakdown. In addition, please design the device taking into considerate the effect of IC heat radiation with peripheral components.
- Installation to Heat Sink
  Please install the power IC to the heat sink not to apply excessive mechanical stress to the IC. Excessive mechanical stress can lead to package cracks, resulting in a reduction in reliability or breakdown of internal IC chip. In addition, depending on the IC, the use of silicon rubber may be prohibited. Check whether the use of silicon rubber is prohibited for the IC you intend to use, or not. For details of power IC heat radiation design and heat sink installation, refer to individual technical datasheets or IC databooks.

## RESTRICTIONS ON PRODUCT USE

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  The product is often the final stage (the external output stage) of a circuit. Substandard performance or malfunction of the destination device to which the circuit supplies output may cause damage to the circuit or to the product. 030619_R

About solderability, following conditions were confirmed

- Solderability

  (1) Use of Sn-37Pb solder Bath
  - solder bath temperature = 230°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux

  (2) Use of Sn-3.0Ag-0.5Cu solder Bath
  - solder bath temperature = 245°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux