



## 带有 3D 环绕和低音增强的 125mW 免输出耦合电容 立体声线路驱动器/耳机放大器

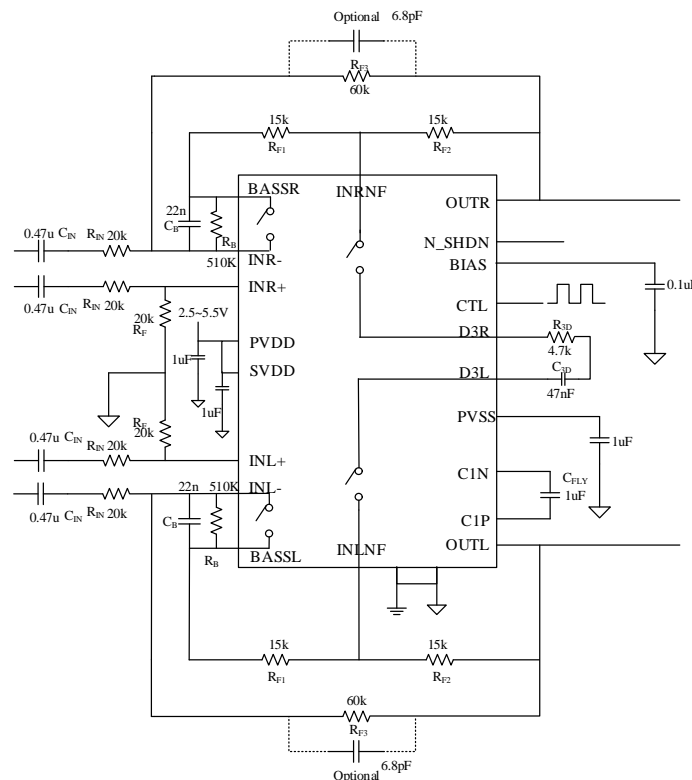
### ■ 特点

- 3D 环绕可调
- 低音增强可调
- 耳机输出无需隔直电容，节省空间和成本，并保证完整低音
- 卓越的低频保真度
- 业界首次消除开关 SD 的 click-pop 声
- 非凡的失真水平，THD+N 最低至 0.001%
- 出众的噪声信噪比，VN: 7uV, SNR : 112dB
- 支持全差分输入和单端输入
- 输出能力：125mW (fIN = 1kHz, VDD=5V, RL=32Ω, THD+N=1%);  
3Vrms (fIN = 1kHz, VDD=5V, RL=1kΩ, THD+N<0.1%);  
2Vrms (fIN = 1kHz, VDD=5V, RL=600Ω, THD+N<0.1%);
- 极度精简外围，QFN24L-PP 4mm\*4mm 封装

### ■ 应用

- 蓝牙耳机
- 智能手机
- 音响，DVD
- 平板/笔记本电脑
- 机顶盒
- 便携式游戏机

### ■ 典型应用图



### ■ 概述

HT97230为差分输入、可直接输出的线路驱动器/耳机放大器。5V供电时，器件为1kΩ负载提供3VRMS输出驱动；3.3V供电时，为600Ω负载提供2VRMS输出驱动。5V供电时，器件为32Ω耳机负载提供125mW驱动。IC具有6dB内部固定增益，也可利用外部电阻设置增益（目前仅提供外部电阻设置增益版本，其他版本需预定）。IC在整个音频频带内提供优异的THD+N。

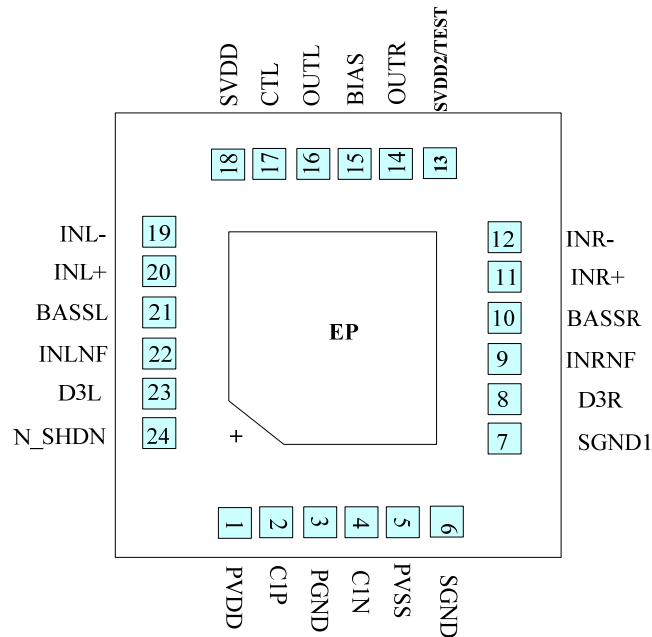
HT97230有两个不同开启时间( $t_{ON}$ )版本，版本A、C和E的导通时间 $t_{ON}$ 为5.5ms，用于耳机驱动；B和D则具有130ms的 $t_{ON}$ ，用于机顶盒设计（目前仅提供A版本，其他版本需预定）。内部电荷泵对输入电源反相，产生负电源。放大器的输出级由输入正电源和电荷泵输出负电源供电，双极性供电使得输出偏置在零电位，省去了大尺寸、容易引入失真的输出耦合电容。ICSD开关时没有咔嗒/噼啪声。

HT97230具有3D环绕模式，能够在立体声耳机上创造3D环绕声的感觉。HT97220还有具有低音增强模式，可依据耳机频响特性，对某个频段的低音进行不同程度的提升增强，达到低音增强的效果。

HT97230提供无铅无卤QFN24L-PP封装，提供QFN20L-PP封装的定制需求。



## ■ 引脚信息



## ■ 引脚定义

| PIN | NAME       | FUNCTION                                                                           |
|-----|------------|------------------------------------------------------------------------------------|
| 1   | PVDD       | Charge-Pump Power-Supply Input. Bypass to PGND with 1uF.                           |
| 2   | C1P        | Positive Flying Capacitor Connection. Connect a 1uF capacitor between C1P and C1N. |
| 3   | PGND       | Power Ground. Connect PGND and SGND together at the system ground plane.           |
| 4   | C1N        | Negative Flying Capacitor Connection. Connect a 1uF capacitor between C1P and C1N. |
| 5   | PVSS       | Negative Charge-Pump Output. Bypass to PGND with 1uF.                              |
| 6   | SGND       | Signal Ground. Connect PGND and SGND, SGND1 together at the system ground plane.   |
| 7   | SGND1      | Signal Ground. Connect PGND and SGND, SGND1 together at the system ground plane.   |
| 8   | D3R        | 3D control pin.                                                                    |
| 9   | INRNF      | Right channel feedback.                                                            |
| 10  | BASSR      | Right channel Bass control output.                                                 |
| 11  | INR+       | Right Positive Polarity Input                                                      |
| 12  | INR-       | Right Negative Polarity Input                                                      |
| 13  | SVDD2/TEST | Signal Path Power-Supply Input. Bypass to PGND with 1uF. Connect directly to PVDD. |
| 14  | OUTR       | Right Direct Drive Output                                                          |
| 15  | BIAS       | Internal Supply Node. Bypass to PGND with 0.1uF.                                   |
| 16  | OUTL       | Left Direct Drive Output                                                           |
| 17  | CTL        | 3D and Bass function control.                                                      |
| 18  | SVDD       | Signal Path Power-Supply Input. Bypass to PGND with 1uF. Connect directly to PVDD. |
| 19  | INL-       | Left Negative Polarity Input                                                       |
| 20  | INL+       | Left Positive Polarity Input                                                       |
| 21  | BASSL      | Left channel Bass control output.                                                  |
| 22  | INLNF      | Left channel feedback.                                                             |
| 23  | D3L        | 3D control pin.                                                                    |
| 24  | N_SHDN     | Active-Low Shutdown. Drive N_SHDN high for normal operation.                       |
|     | EP         | Exposed Pad. Connect at the system ground plane.                                   |



## ■ 功能描述及应用信息

### 1. 模式控制

通过pin17 CTL的控制，可使HT97230进入不同的工作模式。该引脚支持两种控制方式：

#### (1) 电压控制方式

在CTL引脚输入一定的电压，可使HT97230进入不同的工作模式，具体如下表：

Table. 1 CTL mode control with voltage

| CTL voltage       | Working mode           |
|-------------------|------------------------|
| 0.8*PVDD~PVDD     | CTL control with pulse |
| 0.6*PVDD~0.8*PVDD | BASS + 3D              |
| 0.4*PVDD~0.6*PVDD | 3D                     |
| 0.2*PVDD~0.4*PVDD | BASS                   |
| 0~0.2*PVDD        | Normal                 |

#### (2) 一线脉冲模式

但CTRL拉高至PVDD（如上表1），在CTRL引脚输入不同脉冲数，即可进入不同的工作模式，如下表：

Table. 2 CTL mode control with pulse

| Amount of pulses | Working mode |
|------------------|--------------|
| 3                | BASS + 3D    |
| 2                | 3D           |
| 1                | BASS         |
| 0,4              | Normal       |

### 2. Normal Mode

增益设置：

$$AV0 = R_F/R_{IN}, (R_F = R_{F3}/(R_{F1}+R_{F2}))$$

### 3. Bass Mode

低音增强+3dB频率点

$$f_B = \frac{R_{F3} - 0.75 * (R_{F2} + R_{F1})}{2\pi * 0.75 * \{(R_{F2} + R_{F1})^2 + R_{F3} * (R_{F1} + R_{F2})\} * C_B}$$

### 4. 3D Mode

3D环绕音效功能启动+3dB频率点

$$f_{3D} = \frac{1}{2\pi(R_{3D} + \frac{R_{F1} + R_{F2}}{R_{F1} + R_{F2} + R_{F3}})C_{3F}} \approx \frac{1}{2\pi R_{3F} C_{3F}}$$

### 5. 输入滤波器

输入电容C<sub>IN</sub>与输入电阻R<sub>IN</sub>组成高通滤波器，其截止频率影响低频信号的输入。截止频率：

$$f_{-3dB} = \frac{1}{2\pi R_{IN} C_{IN}};$$

### 6. 输入电容C<sub>IN</sub>，输入电阻R<sub>IN</sub>，反馈电阻R<sub>F</sub>

输入电容C<sub>IN</sub>，输入电阻R<sub>IN</sub>，反馈电阻R<sub>F</sub>应尽可能使用高精度器件，以使芯片发挥更优秀的失真、信噪比等性能。



PCB Layout

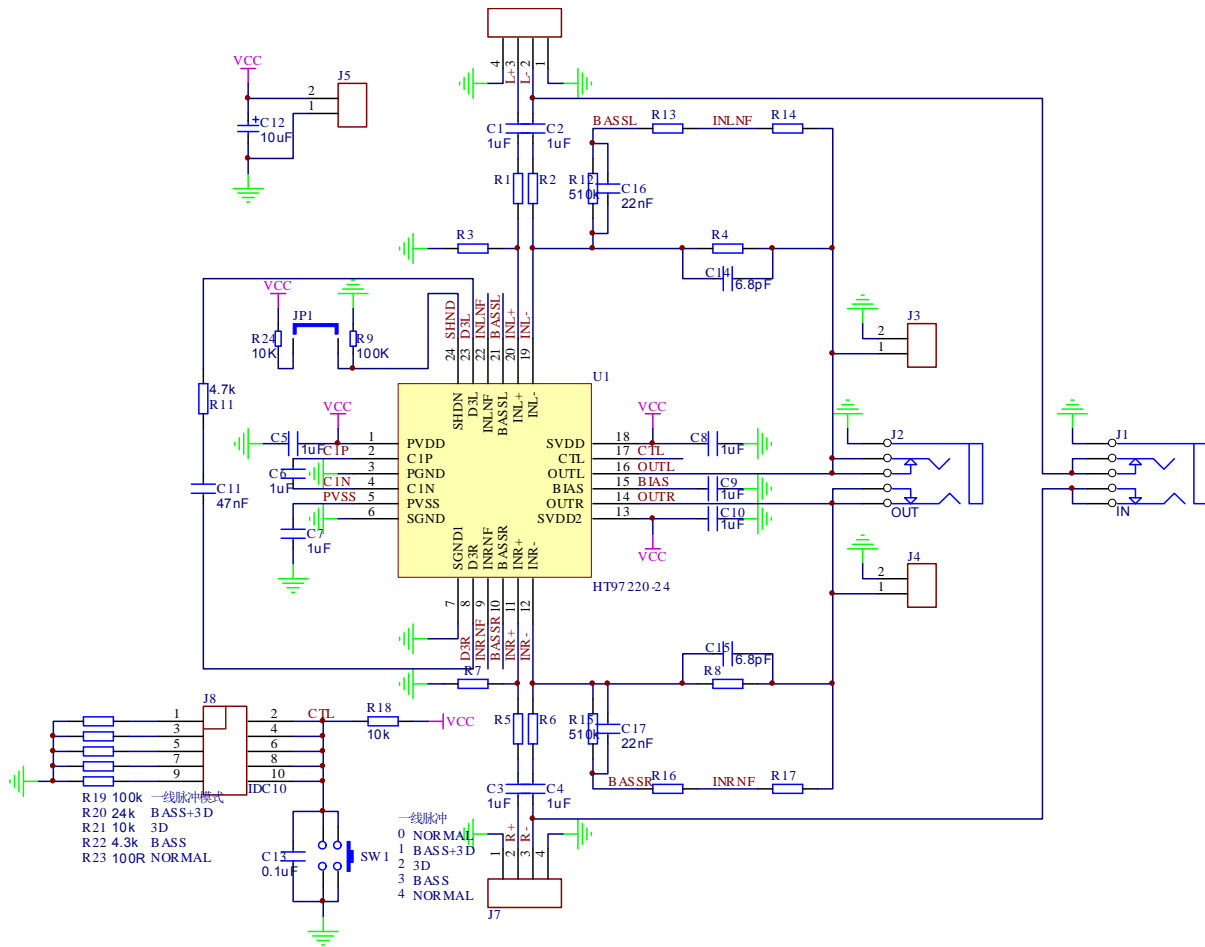


Fig. 1 Schematic Diagram of HT97230 Demo Board

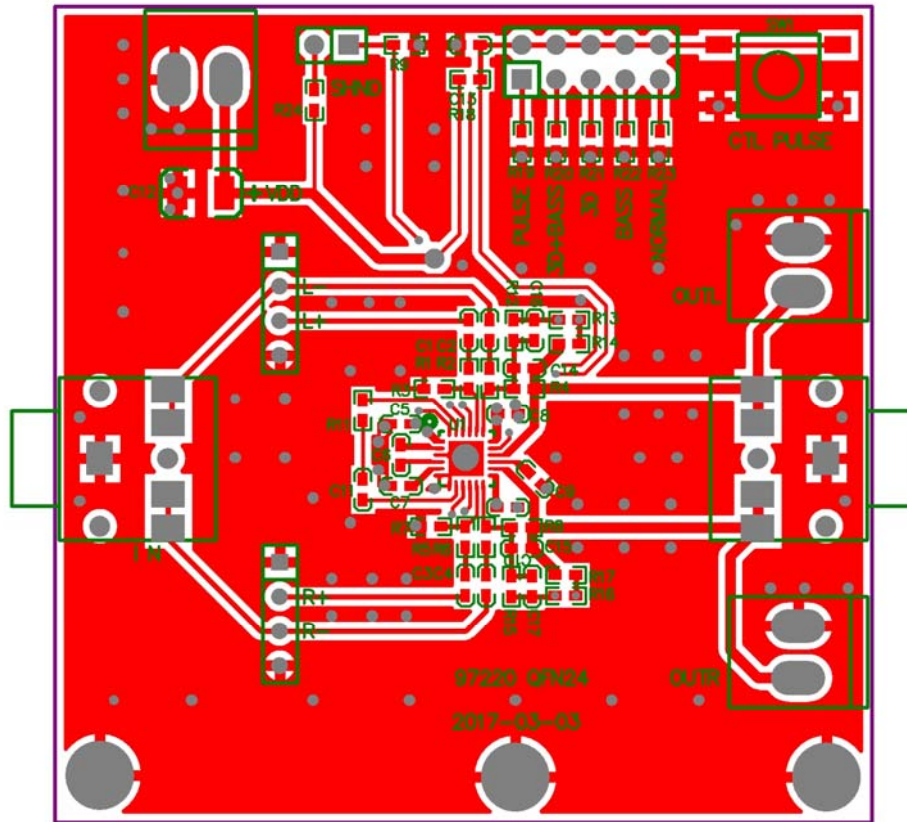


Fig.2 Top View of HT97230 Demo Board PCB Layout

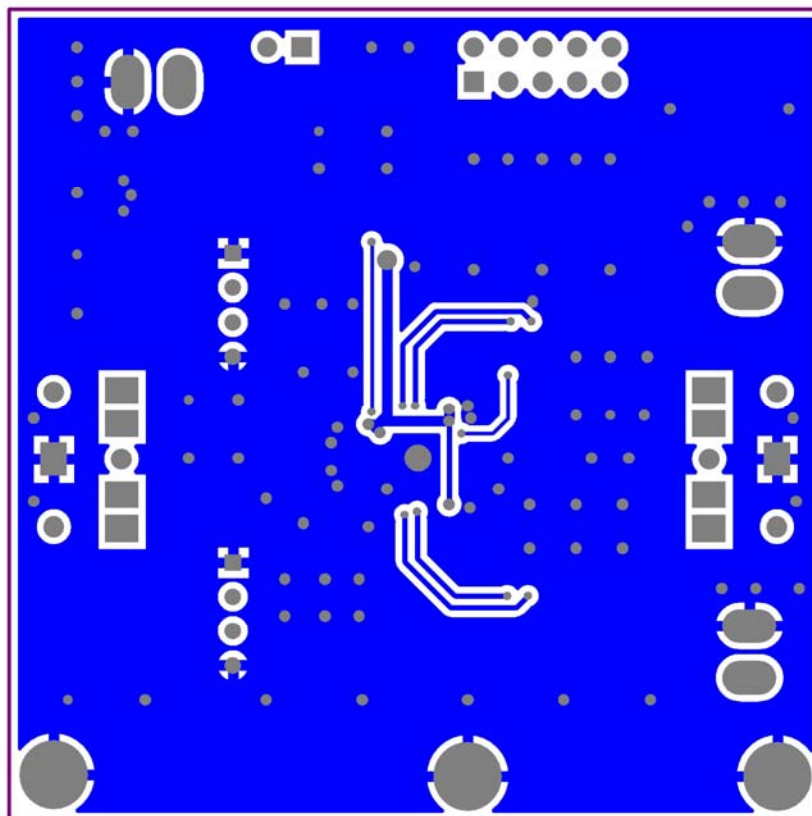
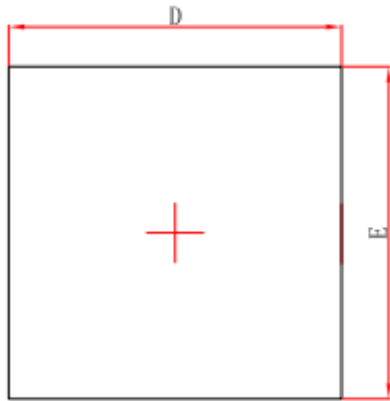


Fig.3 Bottom View of HT97230 Demo Board PCB Layout

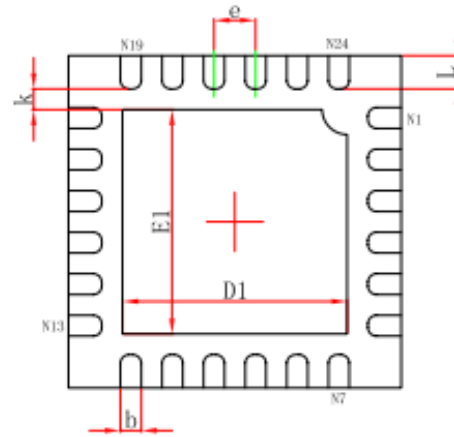


## ■ 封装外形

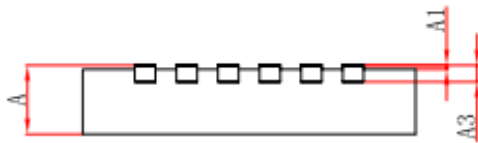
QFNWB4×4-24L (P0.50T0.75/0.85) PACKAGE OUTLINE DIMENSIONS



Top View



Bottom View



Side View

| Symbol | Dimensions In Millimeters |             | Dimensions In Inches |             |
|--------|---------------------------|-------------|----------------------|-------------|
|        | Min.                      | Max.        | Min.                 | Max.        |
| A      | 0.700/0.800               | 0.800/0.900 | 0.028/0.031          | 0.031/0.035 |
| A1     | 0.000                     | 0.050       | 0.000                | 0.002       |
| A3     | 0.203REF.                 |             | 0.008REF.            |             |
| D      | 3.900                     | 4.100       | 0.154                | 0.161       |
| E      | 3.900                     | 4.100       | 0.154                | 0.161       |
| D1     | 2.600                     | 2.800       | 0.102                | 0.110       |
| E1     | 2.600                     | 2.800       | 0.102                | 0.110       |
| k      | 0.200MIN.                 |             | 0.008MIN.            |             |
| b      | 0.180                     | 0.300       | 0.007                | 0.012       |
| e      | 0.500TYP.                 |             | 0.020TYP.            |             |
| L      | 0.300                     | 0.500       | 0.012                | 0.020       |