

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 (f_{IN} = 1kHz, VDD=5V, R_L=32Ω, THD+N=1%);
3Vrms (f_{IN} = 1kHz, VDD=5V, R_L=1kΩ, THD+N<0.1%);
2Vrms (f_{IN} = 1kHz, VDD=5V, R_L=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

■ 概述

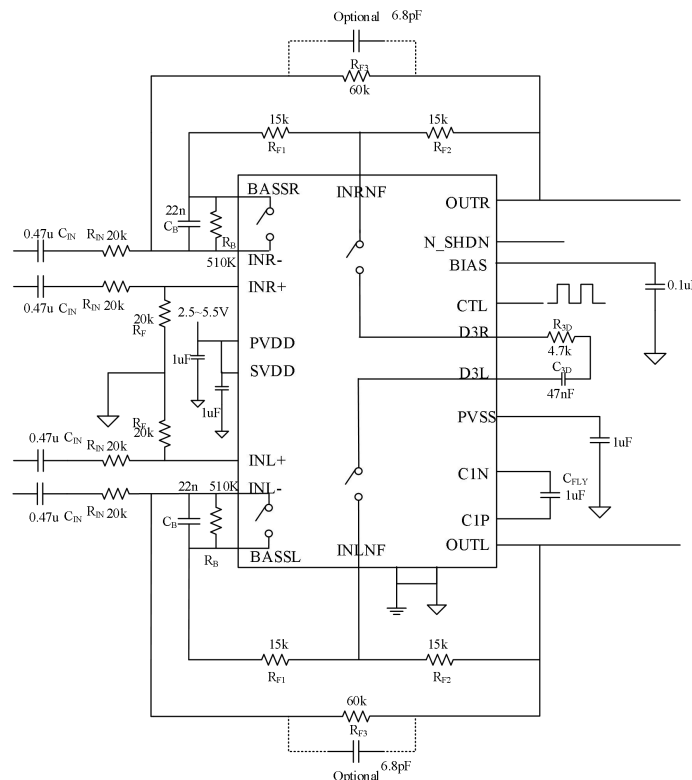
■ 典型应用图

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。

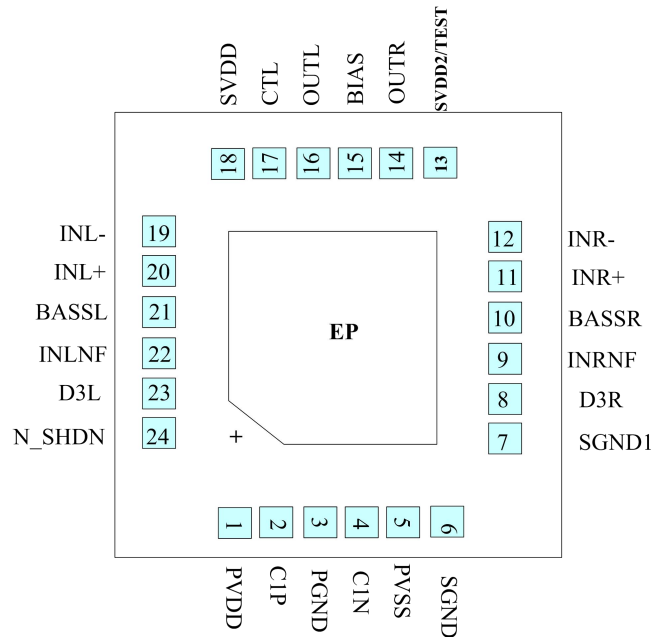
HT97230有两个不同开启时间(t_{ON})版本，版本A、C和E的导通时间t_{ON}为5.5ms，用于耳机驱动；B和D则具有130ms的t_{ON}，用于机顶盒设计（目前仅提供A版本，其他版本需预定）。内部电荷泵对输入电源反相，产生负电源。放大器的输出级由输入正电源和电荷泵输出负电源供电，双极性供电使得输出偏置在零电位，省去了大尺寸、容易引入失真的输出耦合电容。ICSD开关时没有咔嗒/噼噓声。

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_{IN}与输入电阻R_{IN}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_{IN}，输入电阻R_{IN}，反馈电阻R_F

输入电容C_{IN}，输入电阻R_{IN}，反馈电阻R_F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

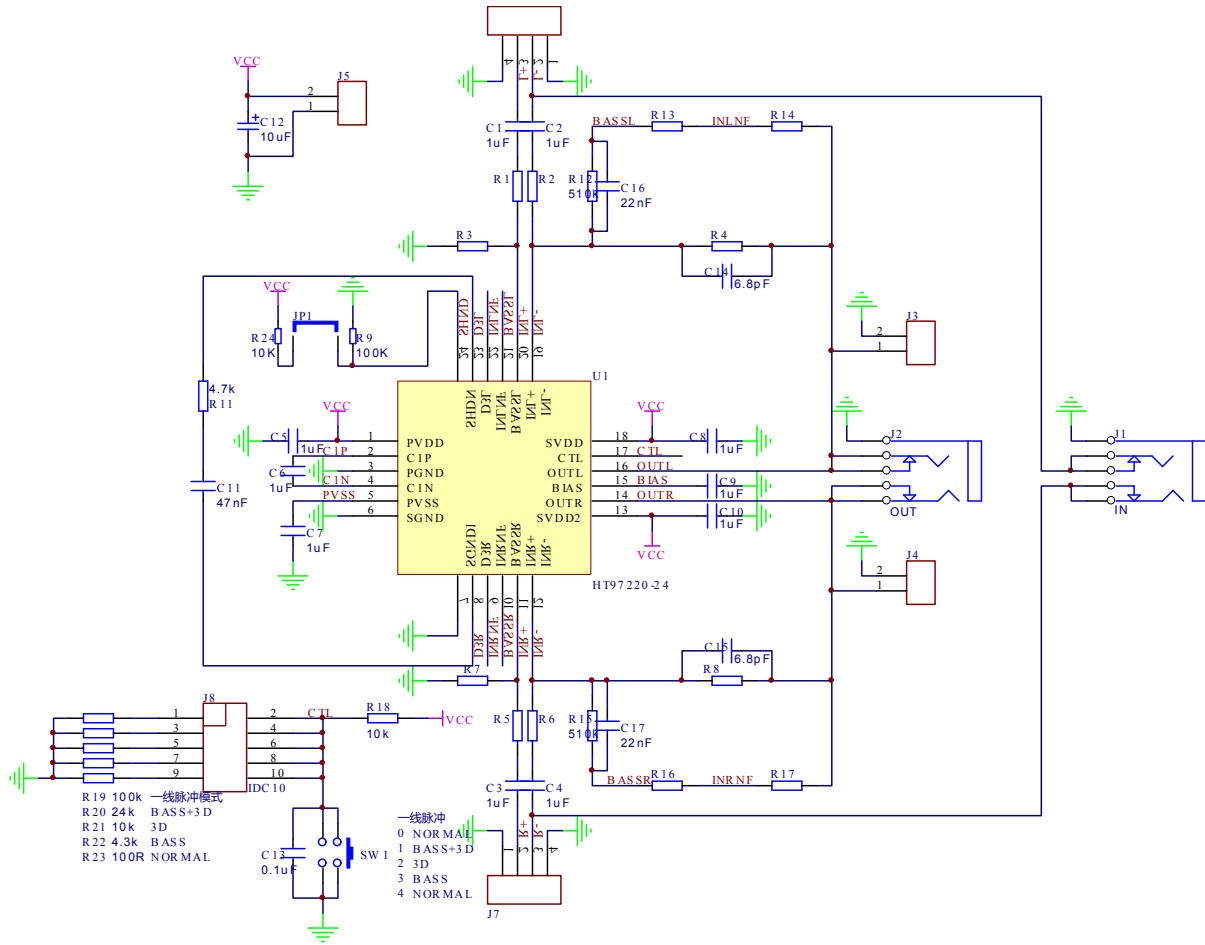


Fig. 1 Schematic Diagram of HT97230 Demo Board

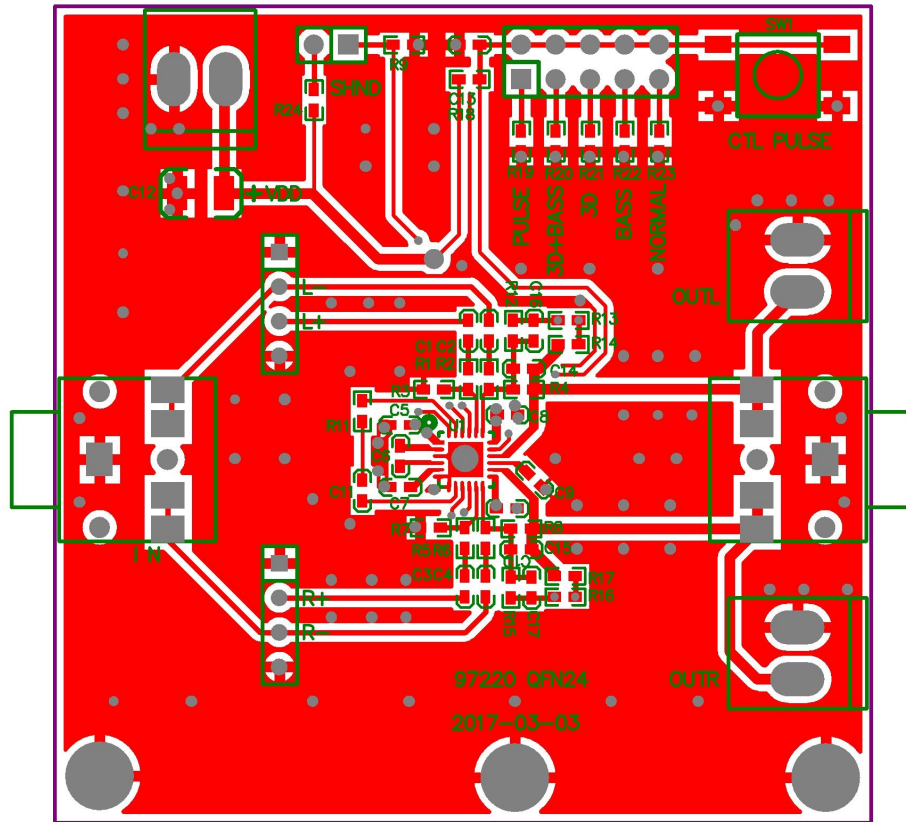


Fig.2 Top View of HT97230 Demo Board PCB Layout

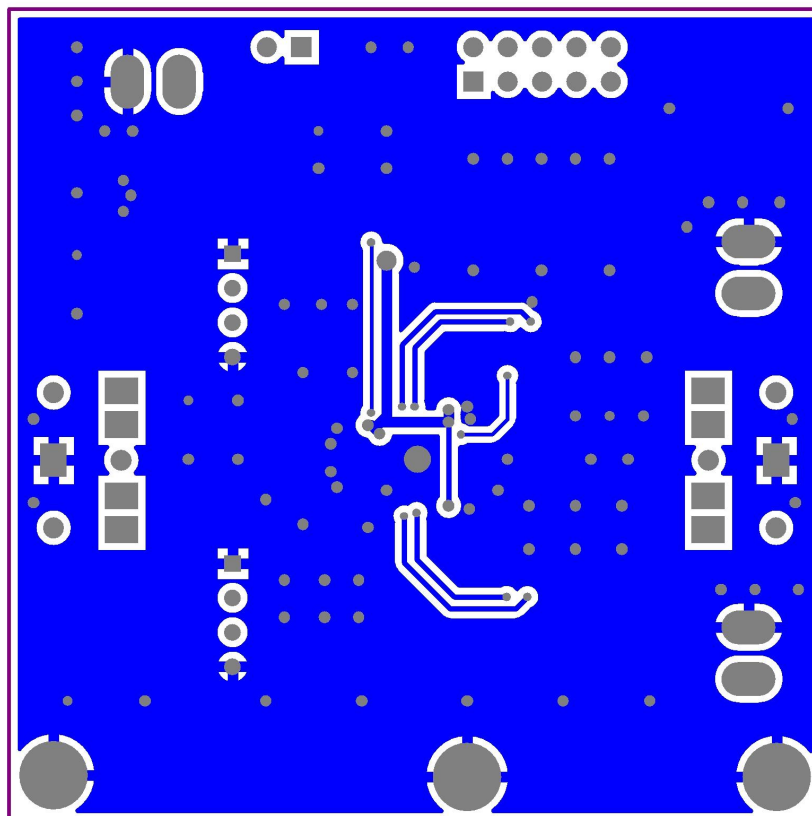
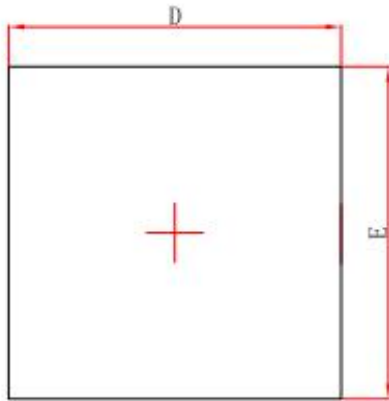
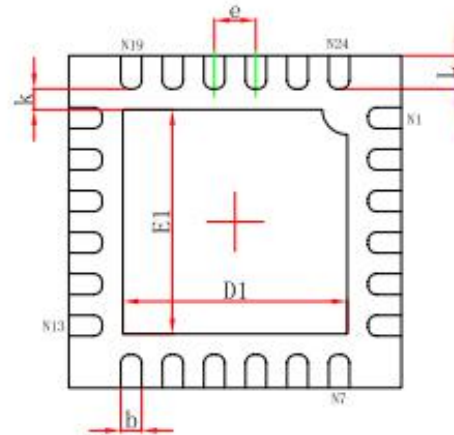


Fig.3 Bottom View of HT97230 Demo Board PCB Layout

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

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嘉兴禾润电子科技有限公司

Jiaxing Heroic Electronic Technology Co., Ltd.

地址：浙江省嘉兴市凌公塘路3339号JRC大厦A座三层

Address: A 3rd floor, JRC Building, No. 3339, LingGongTang Road, Jiaxing, Zhejiang Province

Sales: 0573-82583866, sales@heroic.com.cn

Support: 0573-82586151, support@heroic.com.cn

Fax: 0573-82585078

Website: www.heroic.com.cn; wap.heroic.com.cn

Wechat MP: HEROIC_JX

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