



Application AB-044

作品名稱

單晶片設計之掌上型5.1聲道100W大功率全數位D類音頻擴大機

A Palm-Size 5.1-Channel 100W High-Power Fully-Digital Class-D Audio Amplifier with Single-Chip Design

隊伍名稱

掌上百瓦 100W-in-Palm

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作品摘要

傳統上實現5.1聲道大功率音頻擴大機為使用多顆晶片且需大體積散熱裝置，因此目前市面上尚未見到縮小至可攜式甚至是掌上型的大功率音頻擴大機。掌上型5.1聲道音頻擴大機具有容易攜帶與移動的優點並可以方便地連結裝置來提供環繞音效，是一個具發展潛力的產品。本團隊運用自有之技術歷經多年時間後成功地將控制電路、訊號處理電路、保護電路與5.1聲道數位輸入D類功率放大電路整合於單一晶片，並使用此單晶片配合相關零組件與可程式化的微控制器 (micro controller) 完成一個掌上型5.1聲道大功率音頻擴大機。

本團隊所成功開發的5.1聲道掌上百瓦音頻擴大機總方均根 (root-mean-square, RMS) 輸出功率為100瓦特且功率效率 (power efficiency) 達88% 可以不需額外散熱片，所使用的雙層電路板含零組件後體積僅為12cm x 10cm x 3.5cm。總諧波失真 (total harmonic distortion + noise, THD + N) 可低至0.045%，於100瓦特方均根輸出功率時的THD + N亦小於0.3% (國外知名產品在最大輸出功率的THD + N一般為1%或10%)，使用業界常見量測標準所得的訊號雜訊比 (signal-to-noise ratio, SNR) 與動態範圍 (dynamic range) 均大於90dB。量測數據顯示本團隊所完成的作品不僅體積極小且效能超越相同瓦數的國外知名品牌產品並可媲美高級音響的性能。

Abstract

Traditionally, a 5.1-channel audio amplifier with large output power includes several chips and a large heatsink. Up to now, portable or even palm-size 100W amplifiers are not commercially available. A palm-size amplifier can be easily carried and connected to multimedia sources. It is a product with great market potential. Our team members develop new techniques and spend many years to successfully integrate control circuits, signal processing circuits, protection circuits and 5.1-channel digital class-D power-amplification circuits in a single chip. By using this single chip, a 100W-in-Palm 5.1-channel audio amplifier is realized.

The total root-mean-square (RMS) output power of the amplifier is 100W. The maximum power efficiency is 88% and no extra heatsink is needed. The dimension of a 2-layer printed circuit board used in the 100W-in-Palm amplifier is only 12cm x 10cm x 3.5cm. The minimum total-harmonic-distortion-plus-noise (THD + N) is 0.045% and the THD + N measured at 100W RMS output power is less than 0.3%. For the products with famous brands, THD + N at maximum output power is usually 1% or 10%. The signal-to-noise ratio (SNR) and dynamic range measured with commonly used standards in audio industry are higher than 90dB with A-weighted function. The measurement results reveal that the 100W-in-Palm amplifier achieves smaller volume and better performance than those of the famous-brand products with the same output power. Moreover, audio fidelity of the 100W-in-Palm amplifier is comparable to high-end audio amplifiers.