
Stereophonic Sound for Portable Applications



Stereo sound a necessity for 3G mobile phone features

With the arrival of new 3G generation handsets, the mobile phone has become a delivery vehicle for high quality entertainment content. This new generation of accessible-anywhere features (such as FM radio reception, TV reception, live video messaging and video gaming) demand high quality stereo audio systems. Consequently, for these new features to come up to consumer expectation, and to encourage the penetration of these high-end features into the wider market, quality portable stereo audio systems are a key need for mobile phone manufacturers, and manufacturers of other portable media-enabled applications.

Mobile phone market segmentation

Mobile phone models can vary greatly in complexity from each other, depending on the features offered (mono sound, stereo sound, agenda/PDA features, etc.).

It is impossible to put a hard and fast marketing classification in place, because the industry is still evolving very quickly. "Standard features" are constantly evolving as higher-end technology becomes more affordable.

Nonetheless, marketers like to classify models to:

- give an indication of the features included,
- give an indication about the end-user/potential customer,
- determine pricing.

For example, business models are more prestigious than entry level models, are sold at higher prices and offer features that are specific to business needs, such as Bluetooth® hands-free capability, and in-built agenda and e-mail messaging possibilities.

Generally speaking, mobile phones can be divided into 7 classes:

1. Low-end or entry-level models
2. Mid-range models
3. Specialist models (such as resistant or weather-proof models for rigorous outdoor use)
4. Business-use models
5. Fashion/Style models
6. Communicator models
7. 3G models

Currently, the low-end, mid-range and specialist models do not generally require stereo sound features.

And business model phones are geared to more work-related, and less leisure-related uses, so stereo sound, again, is rarely used.

It is in the last three categories that we begin to see a serious uptake in features that demand stereo audio capability.

Portable stereo sound applications abound

High-end mobile phones are not the only applications that require high quality stereo-effect audio to succeed. Other portable devices such as portable DVD players, high-end PDAs, laptop computers and video gaming devices all require stereo audio sound provided by in-built low power speakers.

The challenge of providing stereo sound on a small device

Stereo audio sound provided by two speakers mounted onto a mobile phone allows one to enjoy polyphonic ring-tones, FM radio reception, or music.

However, to accommodate the small size of today's cellular handset or other portable applications, stereo audio solutions must be designed to deliver maximum performance when the micro-speakers are mounted closely together, and in close proximity to other electronic devices.

Stereo audio drivers must also compensate for the more limited dynamic range available using micro-speakers, as well as for limitations imposed by audio compression technologies.

STMicroelectronics has, for some years now, been building a portfolio of low power audio amplifiers, with mobile phone and portable audio device applications in mind.

ST's newest generation of low power audio amplifiers offer stereo audio features, and will soon be available in Class D architecture, in addition to Class AB.

Two new stereo audio amplifiers, TS4984 and TS4985, are designed specifically for stereo speaker systems on portable devices. Operating from a single 2.2V to 5.5V supply, these audio amplifiers combine a number of advantages that make them highly suited for compact, portable audio applications.

The TS4984 has several new features, including a patented pop and click suppression function during the start up and shut down phases, which saves both power and cost to the end user.

The TS4985 is the same design as the TS4984, but adds two dedicated Standby pins for each output Power stage, and therefore more versatility.

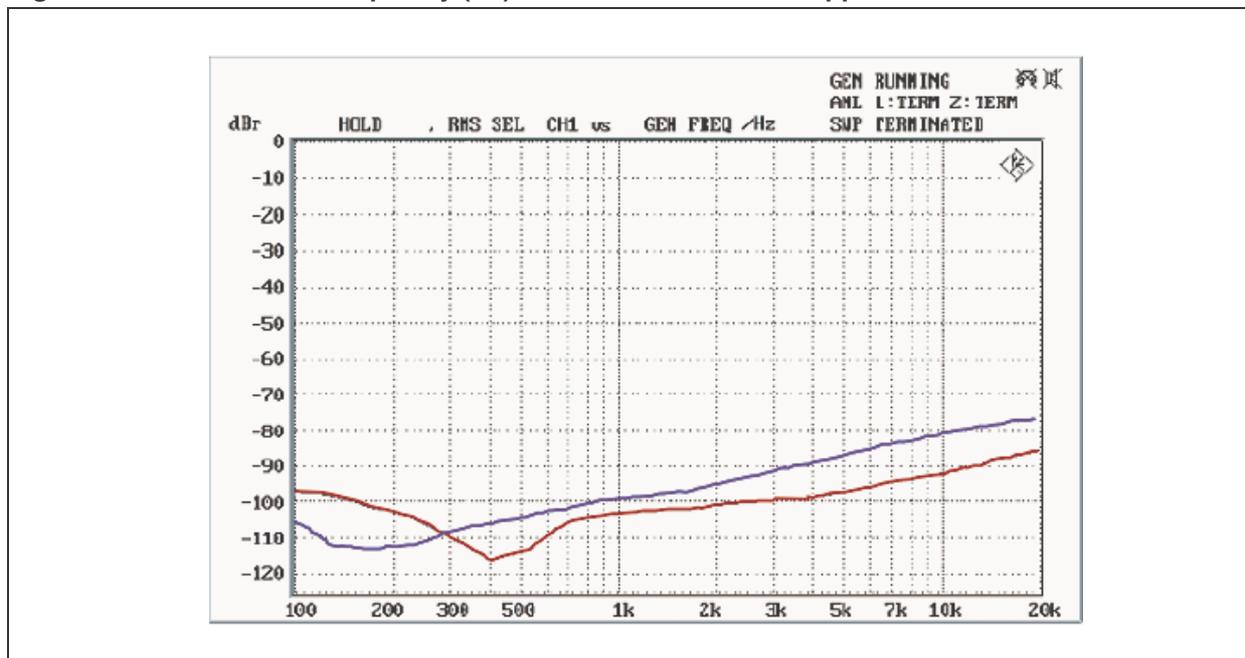
Both offer a complete audio solution by combining a stereo 1 W bridge-tied load (BTL) speaker amplifier in a tiny package (both 16-pin QFN and 15-bump flip-chip packages are available).

Power-saving features include a low 1mV offset voltage to minimize DC current drain through the speakers, a low 7mA supply current, and a 10nA shutdown mode. All devices include a thermal and short-circuit protection, and are specified over the extended -40°C to $+85^{\circ}\text{C}$ temperature range.

To meet the challenges posed by the physical proximity of speaker placement on the device, and the overall compactness of the application components, these devices have been designed with three important performance features in mind.

The first, is very low crosstalk demonstrated by these devices. With left and right speakers in such close proximity, crosstalk is a major worry. However, the TS4984 and TS4985 both show extremely high resistance to crosstalk between channels. A measurement of crosstalk made by testing in situ in application confirms the excellent performance of the TS4985/TS4985 in terms of cross talk (*Figure 1*).

Figure 1. Crosstalk vs. frequency (Hz) measured in situ in an application



The second key advantage shown by these devices is their high PSRR of 62dB, allowing operation from noisy supplies without additional power conditioning. This is an extremely important factor for portable applications, where the audio components are never located very far from the power supply. *Figure 2* and *Figure 3* show PSRR curves under two separate testing conditions.

Figure 2. PSRR vs. frequency measurement for Cb=0.1 F and Cin=1 F

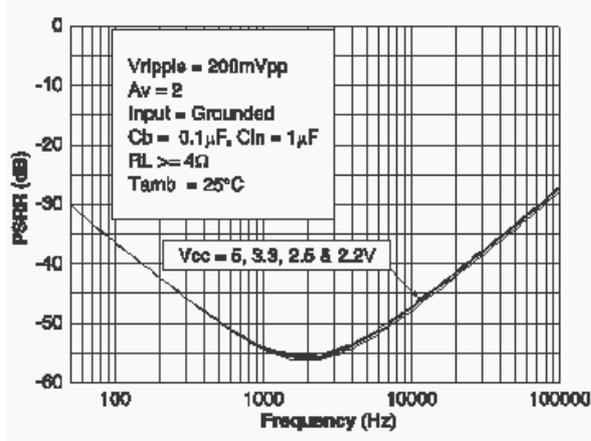
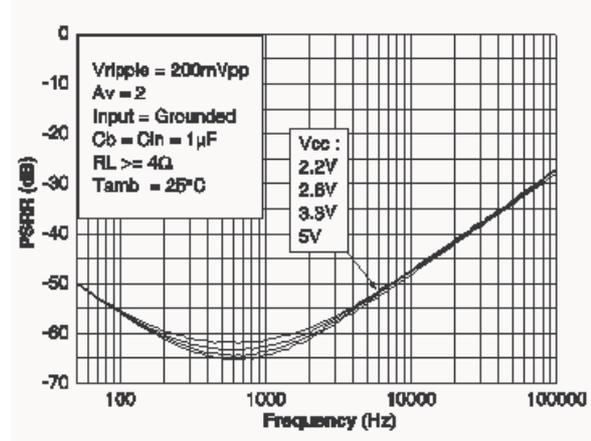
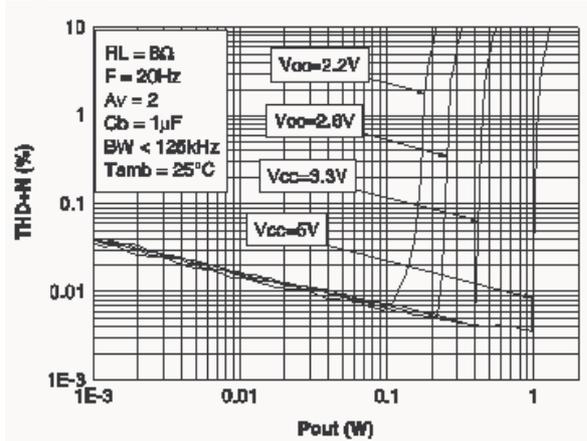


Figure 3. PSRR vs. frequency measurement for Cb=Cin=1 F



The third key advantage shown by these devices is low noise. Ultra-low 0.1% THD+N ensures clean, low-distortion amplification of the audio signal. Figure 4 shows a measurement of THD+N vs. Pout for the TS4984 and TS4985.

Figure 4. THD+N vs. Pout



With these two new products and an ever-growing low power audio amplifier portfolio, ST is committed to providing standard product solutions for advanced consumer applications.

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