NXP audio system TFA9887 with adaptive sound maximizer and speaker protection

Get the most sound from your small speaker

Housed in a small, cost-efficient wafer-level chip-scale package, this complete audio system includes an embedded DSP (running advanced algorithms for speaker boost and protection), a high-efficiency 2.65 W Class-D audio amplifier, and an intelligent DC-to-DC converter.

End-user benefits

▸ Louder sound: the maximum possible from small speakers
▸ Deeper bass: reproduces lower frequencies than traditional systems
▸ Better quality: unmatched sound clarity with less clipping in the amplifier and less distortion from the speaker
▸ Longer life: prevents speaker damage with adaptive excursion control and real-time temperature protection

Key features

▸ Sophisticated algorithm for speaker boost protection maximizes audio performance
▸ Environmental awareness lets the system adapt automatically to acoustic and thermal changes
▸ Adaptive excursion control guarantees the speaker membrane stays within its rated limit for excursion
▸ Direct, real-time measurement of the voice-coil temperature ensures the system keeps the coil within its rated limit
▸ Advanced clip controller prevents clipping even with a sagging supply voltage
▸ Optional bandwidth extension increases low-frequency response

▸ Dedicated speech mode with speech activity detector
▸ Intelligent 5.3 V DC-to-DC converter maximizes audio headroom from any supply level
▸ Reference output available for Acoustic Echo Cancellation (AEC) in the host processor
▸ High efficiency and low power dissipation
▸ Maximum RMS output power:
  - 1.65 W into 8 Ω at 3.6 V power supply (THD = 1%)
  - 2.65 W into 4 Ω at 3.6 V power supply (THD = 1%)
▸ Wide supply voltage range (fully operational from 2.5 to 5.5 V)
▸ I²S digital input and output audio interface
▸ WLCSP29 package (3.19 x 2.07 x 0.6 mm)

Applications

▸ Mobile phones
▸ Tablet computers
▸ Portable Navigation Devices (PNDs)
▸ Portable gaming devices
▸ Portable audio players

Ever wanted better sound from your portable device?

Have you ever missed a phone call because your ring tone wasn't audible in a noisy environment? Or did you ever want more bass from your tablet computer so you could enjoy richer sound while watching a video with your friends?

The problem of getting better sound from a small speaker

It's easy to damage small speakers when they're used to produce loud sounds or bass frequencies. At high sound volumes, for example, the speaker temperature can rise quickly and cause the glue in the voice-coil to melt. Similarly, generating the low frequencies required for bass sounds can cause large movements of the speaker membrane, and that can strain or crack the speaker. These kinds of speaker failures can be expensive, especially when they lead to customer returns and damage the brand reputation.

Today's solutions prevent speaker damage by relying on large safety margins for temperature and membrane excursion. Even with this margin, though, the speaker may still exceed its limits or the amplifier driving it will clip the drive signal. Both of these situations can impair sound quality, and, given the modest output level, can result in sound that is far below the speaker's true potential.

Better sound, complete protection: TFA9887

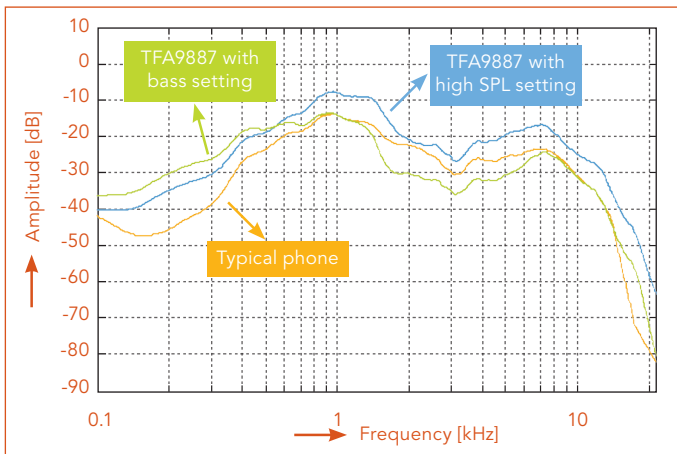The TFA9887 lets the speaker reach its full potential. It measures speaker behavior in real time and uses a sophisticated embedded algorithm to maximize the audio signal. It provides accurate measurements of voice-coil temperature, membrane excursion, and amplifier clipping. The algorithm also monitors the integrated DC-to-DC converter to ensure the best sound quality even when the battery is near the end of its charge. Direct control of the speaker excursion allows improved bass reproduction (of music and speech). The real-time feedback lets the solution adapt to changes in the acoustic environment. The system adjusts and protects the speaker even when the back volume becomes leaky or the speaker port is blocked, resulting in higher sound quality and a longer lifetime.

The TFA9887 includes a low-power CoolFlux™ DSP equipped with an advanced function for speaker boost and a protection algorithm. The embedded DSP is combined with a highly efficient, mono-boosted 2.65 W Class-D amplifier that has current sensing. The protection algorithm uses the current sensing data to maintain a loudspeaker model that determines the real-time state of the speaker. This makes it possible to optimize the audio signal with respect to loudness, bandwidth and quality. The TFA9887 also includes an integrated DC-to-DC converter that, when required, boosts the supply voltage for the needed output power.

The TFA9887 is available in a WLCSP29 package (3.19 x 2.07 x 0.6 mm), under the order number TFA9887UK.

Relative sound pressure versus frequency in a typical phone compared to one with the TFA9887UK

TFA9887 block diagram