

Audio innovation: Trends in Automotive, Smart Home and Pro Audio Applications



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Driven by a growing stream of innovative and enhanced technologies, audio is entering a new era. Here's what you need to know about today's rapidly evolving audio market.

In a decade or so, researchers and historians may look back at today's audio market and describe it as a golden age of innovation. Never before has audio technology advanced so quickly in so many different areas. Sophisticated digital technologies are bringing entertainment, information, communication and system control services to homes, businesses, vehicles and an endless number of other venues.

As innovative audio technologies continue popping up virtually everywhere – on speakers, computers, televisions, mobile devices, automotive sound systems, headsets and conferencing systems – audio quality is reaching levels of performance that designers could only dream of a decade ago. With the arrival of a new generation of semiconductor devices and tool sets created by Texas Instruments (TI), designers are now free to let their imaginations run wild as they develop audio products that cater to every need – even those that people and enterprises didn't realize they had.

Premium audio sets the tempo

For decades, audiophiles have spurred audio manufacturers to reach new performance heights. Today's enthusiasts – rapidly growing in number – are no different, demanding professional-quality sound equaling or surpassing the best concert hall and movie theater experiences. A key benchmark for these consumers is total harmonic distortion plus noise (THD+N). Extremely low THD+N levels enable an audio amplifier to create sound that's virtually indistinguishable from the original recording.

As sound quality improves, audio is growing increasingly immersive. New audio formats are extending the sound field into three dimensions, with ceiling speakers creating an impression of

height. Immersive audio also offers the benefit of being speaker-independent, enabling the same mix to be adapted for playback on different types of sound systems.

Meanwhile, with audio consumers becoming increasingly mobile, wired headphones could soon become a legacy technology. New codecs and associated technologies allow wireless audio to sound better than ever on an emerging generation of wireless headphones and earbuds. Also fueling the trend toward wireless listening is the decision by many smartphone and tablet manufacturers to save space on their devices by removing the traditional 3.5-mm headphone jack.



Automotive audio rolls ahead

Drivers are now seeking the same high-quality audio in their vehicles that they have at home, both for entertainment as well as in systems designed for navigation, information, safety and other important tasks. It's important to note, too, that time spent inside vehicles is increasing due to traffic congestion and longer daily commutes. By providing informative, communicative, collaborative and other important connectivity services, sophisticated audio systems are becoming essential productivity tools for drivers and passengers.

Premium automotive audio systems incorporating multiple speaker arrays aim to create a superior sound environment equaling or exceeding high-end home installations. Some new cars today have as many as 34 speakers positioned at 19 locations throughout the passenger compartment.

Automotive audio technology is currently on the road to integration by combining data converter technology with Class-D amplifiers, creating a one-chip system. TI's Burr-Brown™ Audio amplifiers deliver clear sound while enabling adopters to meet demanding system requirements.

In head units, the trend is toward more channels supporting a variety of new functions, such as center-channel, cluster-chime and warning-tone speakers. Multiple microphone inputs distributed throughout the passenger compartment and audio beamforming with microphone arrays enable drivers and passengers to communicate with interactive services more clearly and effectively.

Audio manufacturers are also beginning to develop systems specifically designed for installation in electric vehicles, which feature interior acoustics that vary significantly from traditional cars and trucks. With electric vehicles, weight-saving opportunities gain a higher importance, and electric engines are much quieter than their gas- or diesel-powered counterparts. The result is a quieter interior environment in which external noise from traffic, wind and rain becomes much more invasive. Audiomakers are addressing this concern – for electric and traditional vehicles alike – by developing noise-cancellation technologies that measure vibration or other types of disruptive sounds and send a countering signal through the vehicle's speakers. The result is a more comfortable and premium driving experience.

As more electric vehicles hit the road, there's an increasing need for lower-current, high-impedance speakers that offer high-quality audio while requiring thinner speaker wire, saving both cost and weight. There's also a growing trend among audiomakers to replace Class-AB amplifiers with Class-D amplifiers to deliver higher power efficiency, and reduce the system's overall thermal dissipation and weight.

Another promising new audio trend for all types of vehicles is the remote amplifier concept. By mounting a central audio-processing electronic control unit inside the vehicle, sending processed audio signals to amplifiers located near the speaker can significantly improve efficiency, sound quality and power distribution.

Home smart home

A new generation of consumer technology is sparking a change in home lifestyle. Smart speakers allow users to stream audio from a variety of sources with a simple spoken request. As smart speakers gain in popularity, manufacturers are concurrently adding the same audio and voice functionality to products such as wireless access points, soundbars, smart thermostats and smart home hubs (that increasingly feature screens).

The presence of digital assistants inside a growing number of next-generation smart home devices presents some design challenges. These once single-purpose devices are not getting any larger, yet need to include hardware for streaming audio and virtual assistance. This can present challenges when adding room-filling audio to an existing design, including space constraints and heat dissipation.

“Following the trend of smart home devices, the audio amplifier is getting smarter, too.”

However, following the trend of smart home devices, the audio amplifier is getting smarter too. TI's SmartAmp features help designers push speakers to their limits, enabling bass enhancement while still protecting the amplifier and system through industry-leading safeguard features like cycle-by-cycle current control and thermal foldback. These features continue to fuel the trend toward smarter, smaller audio devices throughout the home.

Pro audio extends the limits

Pro audio is rapidly transitioning from analog to digital, and and speedy data converters – such as TI Burr-Brown-created data are expediting this transition. Next-generation converters make it possible to transform analog signals into digital in real time with no latency, and to add effects to songs directly on a guitar or mixing board without any noticeable delay.

There's also a growing trend toward network audio. Analog audio distribution suffers from limitations that become more apparent as systems scale up, including signal degradation, distance limitations, and the need for a dedicated cable and connection for each channel in each direction of signal flow. A digital audio network dramatically reduces cabling requirements and virtually eliminates signal degradation. High channel counts are also possible, with significantly less cable required, and system configuration is much more flexible.

Business users increasingly expect audio quality at work that's at least on par with what they hear at home, whether it's for conferencing, giving a presentation or producing a podcast. One way to reach this goal is with integrated digital signal processing (DSP) capabilities, a powerful tool for capturing and processing audio from various sources, particularly smart speakers. DSP benefits include active noise control (the removal of unwanted ambient sounds), echo cancellation and sound enhancement for improved audio quality.

The emergence of intelligent microphone systems used in conjunction with conferencing systems is another important trend enabled by TI Burr-Brown Audio analog-to-digital converters. Intelligent microphone technology automatically and continuously estimates the number and direction of speakers in a room. The microphone array can instantly determine who is speaking, and only the microphone facing the speaker will turn on, while the others will shut off to reduce excess noise.

As many businesses look to add other locations to their traditional conference room options, the costs associated with wiring an area or room for audio conferencing can become cost-prohibitive. Vendors are now responding with wireless audio solutions that eliminate unwieldy wires and cords while providing on-the-fly configurability.

More products will break free from traditional design concepts as audio technology continues to advance. Soundbars, for instance, initially became popular as a way to achieve a better audio experience despite the space limitations caused by slimmer TVs. Now, manufacturers are going back to the drawing board to engineer wireless speakers that can reproduce high-resolution music with precision, as well as wireless battery-operated satellite speakers that can be placed anywhere inside a home or business.

Audio rules

At a time when emerging technologies are attracting media and consumer attention, it's important to remember that audio also continues to impact people's lives at more times and in more ways than ever before. Semiconductors are the building blocks that designers use to turn great audio technology ideas into marketable products. An array of processors, amplifiers, converters, switches and other devices are readily available and rapidly updated, allowing developers to achieve faster design cycles and keep innovation flowing for many years to come.

As they used to say during radio's golden age: Stay tuned for more.

Additional resources

Learn more about [TI Burr-Brown Audio technologies](#).

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