SmartBeat™ digital Active Noise Cancellation solution

USB Type-C and growing storage capacities on smartphones and tablets, combined with online stores like HDtracks and Qobuz, make high-end audio easily accessible to all – anytime, anywhere. The Dialog end-to-end SmartBeat digital Active Noise Cancellation (ANC) solution uses a novel hybrid noise cancellation approach to help you ensure outstanding audio quality in any environment.

Dialog’s SmartBeat DA14x9x’s high-performance audio processor family is built around an ARM microcontroller and Cadence HiFi-3 DSP. Together with a powerful and open software development platform, you have everything you need to develop highly customized and distinctive Audio products. Ideal for wired applications such as USB and USB-C, the DA14195/6 can also be used alongside a Bluetooth host processor as a high-performance audio co-processor to run sophisticated DSP algorithms and sensor fusion.

Among the many advantages of Dialog’s audio platform is the ability to add digital ANC. The DA14x9x’s family architecture is configured to a digital signal processing scheme based on the multi-rate concept which allows it to meet the demanding requirements of an ANC system through integrated fast hardware accelerators and the DSP’s ability to deliver full-resolution analysis. This reduces component count and cost, while adding flexibility and tunability. Building on this capability, the SmartBeat digital ANC solution employs a novel hybrid approach that combines feedforward and feedback paths to deliver the best noise cancellation performance over its entire frequency range.
Digital Hybrid ANC
A hybrid ANC system usually comprises four microphones per headset, one pair per side. The feedforward noise cancellation system uses the external microphone to measure ambient noise before it enters the ear, processing that signal to ensure an exact and opposite signal leaves the system’s speaker to effectively cancel the ambient noise. Meanwhile, the internal microphone is used to create the feedback loop of the feedback noise cancellation system. A filter is used to minimize the acoustical signal near the microphone.

Feedforward

![ANC feed-forward concept](image-url)
Feedback noise cancellation typically operates from 50 Hz to 800 Hz, whereas feedforward cancellation operates from about 80 Hz to 2 kHz. A strong advantage of digital hybrid ANC is that systems can be tuned for various environments, such as office or airplane, and switched seamlessly between the different modes.

**Feedback**

![ANC feedback concept](image)

*Figure 2: ANC feedback concept*
Workflow and ANC development tools
Dialog offers a complete end-to-end solution for ANC through a clear development workflow with all relevant tools for measuring, tuning, testing and production. The workflow and tools cover the whole development cycle from concept to mass production, greatly reducing the design effort for these sophisticated headsets.

Our methodology expands to all phases of creating ANC-capable products, including sensitive parameterization to guarantee full control of performance at all stages. The real-time audio tuning tool together with the ANC simulation can visualize all potential optimizations in early development phases. Comparison over different flavors of ANC performance is now as easy as choose and apply on air.

The easy to use production line calibration tool performs optimization over the hardware component tolerances and ensures maximum performance for all series of the product.

Dialog Digital ANC solution key features
► Hybrid active noise cancellation using both feedback and feedforward
► A complete software suite to design a digital ANC headphone from concept to production
► Powerful, open development platform
► Reference designs available
DA14x9x Audio Processor family solution
Dialog offers complete ANC headphone solutions based upon the DA14x9x audio processor family and DA7217/18 audio codecs. With an industry-standard ARM microcontroller and Cadence / HiFi-3 DSP, plus our powerful and open development platform, you can develop strong brand-distinguishing functionality with excellent audio performance. Reference designs for USB headphones and other audio applications are available to kick start development and cut time to market. Moreover, our ANC solution helps you to reduce component count, cost and the number of parties involved in development.

![Figure 3: DA14195 system block diagram](image)

Our digital ANC solution is available on all DA14x9x family members, in combination with our low-power, high-quality DA7217 and DA7218 audio codecs. Special provisions were made to reduce latency to achieve state-of-the-art performance figures. The DA14x9x family features many industrial-standard digital I/Os which make it an ideal solution to design a USB Type-C ANC, a DECT headset and can also be used as an audio co-processor for Bluetooth applications.
Dialog digital ANC features and benefits
► Powerful and flexible digital ANC solution
► Easy to use development and production tuning tools
► Fast production calibration, lowering test time
► Supported on all Dialogs DA14x9x family of devices
► ANC reference design available for
  - USB Type-C headset
  - Co-processor to Bluetooth or DECT headset
► Available as IP on Dialogs device solutions (royalty baring)
► Configurable to multiple optimized noise environments (Office, Airplane, etc.)
► Very low power