Teardown: Analog rules over digital in noise-canceling headphones

Patrick Mannion - January 11, 2013

I recently wrote about my ongoing search for the perfect truly mobile audio-reproduction experience, and afterward one of you was kind enough to send me a set of NC-255 active-noise-reduction headphones. Manufactured by Hong Kong-based ODM Cobalt Industries and retailing for between $60 and $80, the headphones deliver decent audio at relatively low cost, but what made them particularly interesting to me was the effectiveness of the active noise reduction. I had to dig deeper.

Though the feature is intended for frequent fliers who want to attenuate cabin and engine noise, I tested the headphones’ noise-reduction capability as I sat in a hotel room with my wife and two playing kids nearby, to see whether I could be blissfully unaware of my surroundings while listening to my tunes. Success! Even better, when my attention was (frequently) required, I didn’t have to remove the headphones to listen; a very friendly “hear around you” button attenuated my music and amplified my surroundings. Life just keeps getting easier.
Noise cancellation has been around for years but continues to advance through better algorithms, processes, and methodologies. As mobile applications proliferate, however, power consumption is where the rubber hits the road. That’s why I needed to look inside the headphones and see how the design could get 32 hours off a single AAA battery. On opening the controller, I found the AS3501 all-analog active noise-cancellation IC from AMS.
We like digital noise reduction for its flexibility, but Oliver Jones, marketing manager for power management at AMS, says it’s better to perform the filter-based phase adjustment and signal amplification in the analog domain to meet stringent audiophile requirements and minimize power consumption. I would agree, but of course the devil is in the implementation details.

The AS3501 has proved itself, having been around since 2009, and now costs around $2 (1000). Eight more iterations have followed the introduction; the latest includes Bluetooth for a marginal price increase, to $2.15. AMS provides full design help, and the device is also in OEM brands such as Pinteo and Tivoli. Cobalt also manufactures the NC-255 on an ODM basis for brands such as AT&T, Beats, and Klipsch.