Technical Article

How a Look-ahead Boost Conquers Battery-life Challenges in Speakers

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Life is hard for audio system designers under pressure to design speakers with a longer battery life. “It doesn’t play as long as I wanted” is feedback no marketing team wants to receive.

One easy way to extend battery life is to increase the size of the battery. Yet few systems can bear the increased cost of a larger battery, so selecting a larger battery with more milliampere hours is out.

Another design approach necessitates spending inordinate amounts of time searching for that magic combination of key components like boosts, microprocessors, radio-frequency modules and amplifiers with low power consumption.

Project development time may be too short (or resources too few) to do much more than tweak the current design. Frequently, a design ends up with a simple, constant-output boost to increase the voltage from a 1S battery to 12-V rail to drive a cheap, inefficient TV amplifier at 10 W.

Ironically, a major contributor to the power problem is that cheap, inefficient TV amplifier. Those amplifiers were designed years ago for TVs and speaker bars, both powered by a 24-V regulated rail. But solutions borrowed from yesterday do not translate well to battery-powered designs. Battery life suffers more when a constant-output boost converter continually drains a 1S battery to generate a 12-V rail, even when idling.

Einstein once said that the thinking that created the problem isn’t the thinking needed to solve the problem. So using Einstein for inspiration, consider replacing your regular boost converter with a look-ahead Class-H boost converter and replace the TV amplifier with a higher-efficiency amplifier designed for battery-powered systems. You’ll get bonus points if the entire solution is integrated into one device!

Looking for high efficiency in small speaker applications?

Learn more about the TAS2563 audio amplifier with Class-H boost

The look-ahead processing matches the power consumption to the audio output by constantly analyzing the audio signal and keeping the power within a small envelope of power use, then managing the boost output. This envelope-tracking approach reduces audio power consumption as much as 40%. It also lowers the system bill of materials (BOM) by removing extra components. You can read more about Class-H boost in the application note, *Benefits of Class-G and Class-H Boost in Audio Amplifiers*.

TI devised a test to compare a look-ahead boosted solution to a constant-output boost converter. Our test comprised these steps:

1. Fully charge the 1S battery of the original solution.
2. Connect a TI battery monitor evaluation module to track battery life.
3. Run the speaker at full volume until the battery dies.
4. Repeat the process with the same conditions using a Class-H boost converter.

Figure 1 shows how this the look-ahead boost works: the upper half of Figure 1 shows the battery life of the original boosted amplifier with constant output, while the lower half of Figure 1 shows what a look-ahead Class-H boost can do.

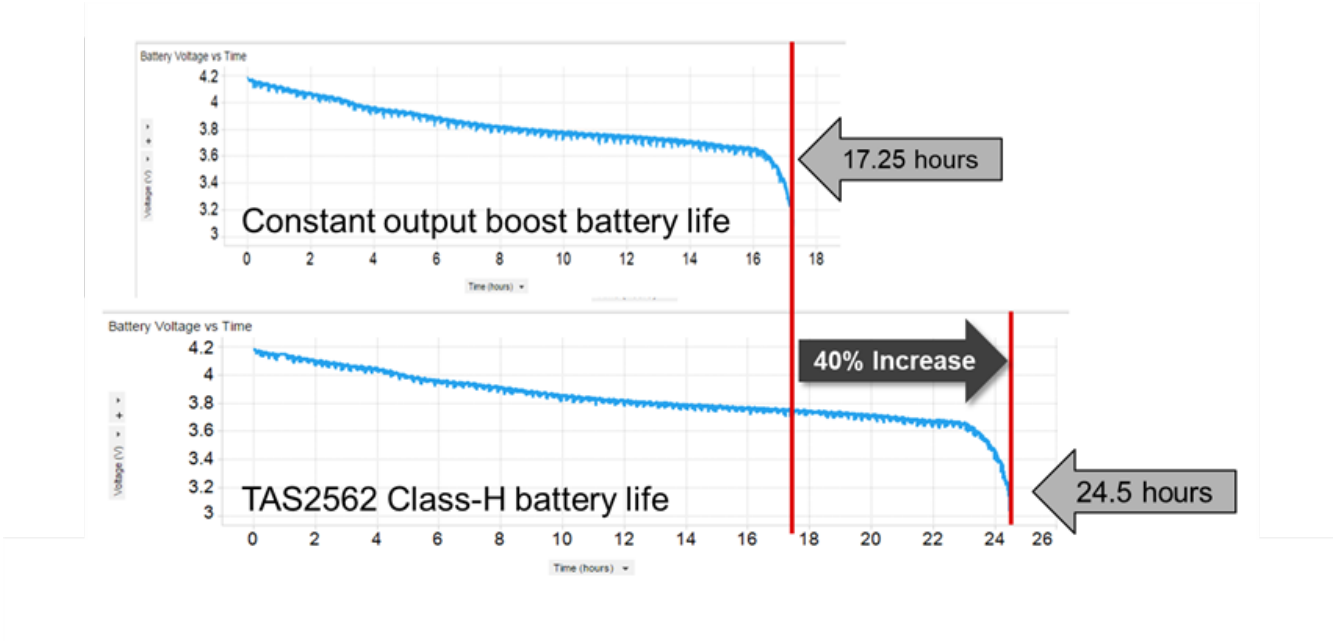

Figure 1. TI's look-ahead Class-H boost reduces power consumption 40%

Figure 2 shows what is happening moment by moment as music plays.

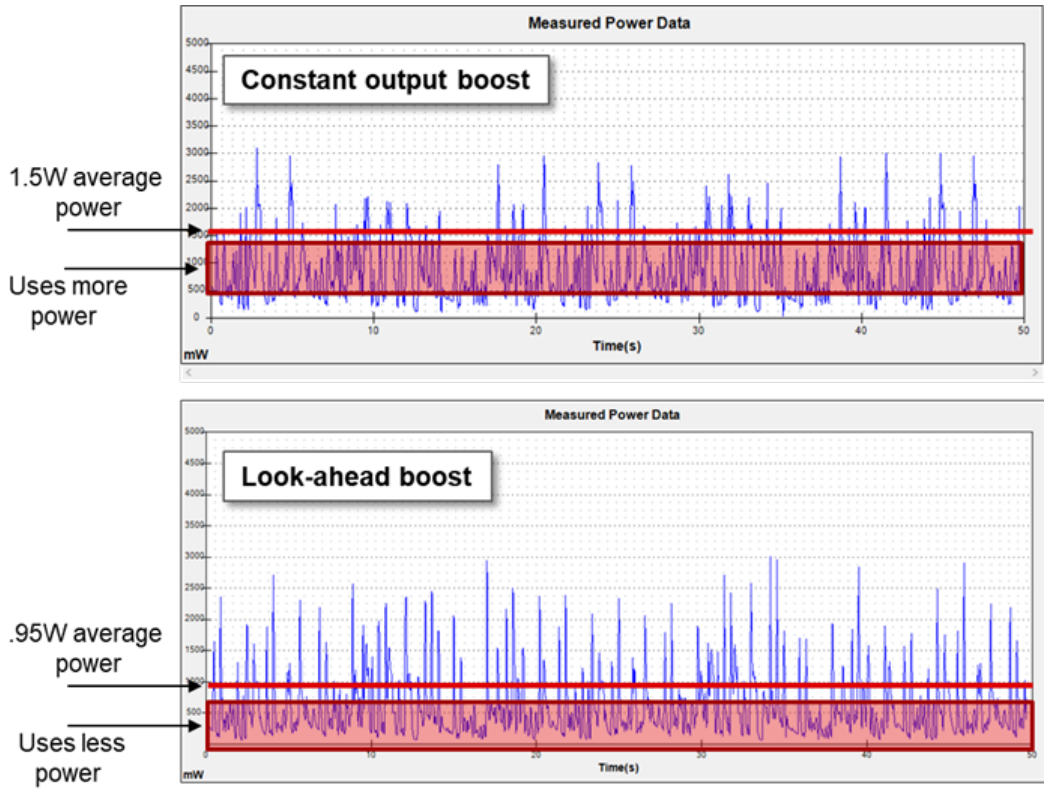

Figure 2. TI's look-ahead Class-H boost uses half a Watt less power on average

The look-ahead boost converter tracks the incoming signal using sophisticated algorithms that manage the power level; it increases and decreases the boost to match the voltage that the amplifier needs. Its capabilities are similar to what you do when driving: you watch the road ahead, then accelerate, coast or brake to match the conditions.

The look-ahead Class-H boost converter controls power consumption in battery-powered systems; our tests and power-consumption comparisons show that this approach is easy and effective. The converter increases battery life and reduces BOM cost because you can drop the external boost and possibly reduce the battery size as well.

For some designers, these two changes alone more than pay for the cost of the amplifier. That's why leading audio brands have this built their own version of a look-ahead boost into their systems and are getting more bass, louder music and longer battery life.

You could emulate the leading brands by creating an effective look-ahead boost control. It takes a bigger processor, a variable boost and software development to track the audio signal and calculate the power needed by the amplifier at just the right moment. It isn't impossible, but it takes time and expertise, and increases BOM.

TI has done all this work for you. These amplifiers start with a 90% efficient Class-D amplifier, then integrate look-ahead processing, a multilevel boost and a tracking algorithm. And with easy-to-use control software, PowerTune amplifiers are a simple path to longer battery life, lower BOM and reduced development time.

Additional resources

- Explore the TAS2563 data sheet.
- Explore the TAS2110 data sheet.
- Learn more about TI's audio amplifier technologies.

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