Technical Description: Beats Headphones

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Definition

Beats Headphones are a Bluetooth audio device with 2 ear cups and a connecting over-the-head band that allow users to privately listen to audio from a separate device. Bluetooth is a wireless technology used to connect devices and operates on 2.4 GHz radio frequencies (Institute of Physics, 2025). They are generally used to listen to music and/or listen to videos in public settings, such as: public transportation, gyms, libraries, study rooms, and any other setting containing leisure activity. Advanced models also allow for methods of hands-free communication such as contacting Siri (a virtual assistant found on Apple devices), pausing/resuming audio without having to come in contact with the connected device, as well as noise cancelling technology.

Figure 1. Overall basic photo of a pair of Beats

Overview

Beats headphones follow the general appearance of most over-the-ear headphones, one cup surrounding each ear with a connecting band over the top of the head. Beats focus on a sleek and minimalistic appearance, the two ear cups and connecting band blend into a singular organic shape. For comfort and extended listening periods, Beats utilize cushioning on the inside of the ear cups. This focus on minimalism and comfort also makes Beats rather lightweight, weighing in at 260 grams, also making the product portable. Beats do have a base size; however, each model is adjustable in size due to a multilayer shell that contains metal sliders on the headband that can expand and retract to fit user preference. Specs of the *Beats Studio Pros* are as follows: 17.8 centimeters in length, 7.8 centimeters in width, and a height of 18.1 centimeters (Beats by Dre, 2025). Beats also offer a multitude of color options depending on the model. The larger and more advanced *Studio Pro* model offers black, deep brown, navy, and sandstone. The smaller *Solo 4* model offers matte black, slate blue, and cloud pink. Each Beats Headphone also sports the Beats logo on each ear cup.

Figure 2. Color variations of the *Beats Studio Pro*

Components

<u>Outer Shell</u>

The outer shell of the ear cups and headband is a singular, organic, connected piece comprised of a synthetic plastic, mostly comprised of Acrylonitrile Butadiene Styrene (Apple, 2024). The outer shell is what gives Beats its primary shape and serves as a protective layer for the interior parts. Further, the outer shell also features functionality in the Bluetooth sector. The ear cups feature built-in buttons that can pause/resume audio or control the volume. Different controls can be chosen by the user. The outer shell also features engineered leather directly medial of the plastic for cushioning and comfort. In the headband region, the plastic and engineered leather are both directly superficial to metal sliders that can be manipulated to control the size of the headphones. Finally, the USB-C charging port (connected to a lithium-ion battery) and power button are in the outer shell on the inferior-most section of the earcup.

Sound

The sound functions of Beats Headphones are enabled by components that are connected to the Bluetooth functions. The main components are drivers, speakers, digital processors for frequency responses, microphones, and earpads (Einstein, 2015). These components receive information from the Bluetooth technology and filter the sound to the user to provide a comfortable experience.

Connectivity

For the audio to be relayed to the user, the components that relay the audio must receive the audio information from the Bluetooth components. Bluetooth contains chip sets, and the newer models utilize the H1 chip (Triggs, 2023). This chip allows for a number of Bluetooth functions.

Explanation

Seamless connections are critical for electronic devices that are used in everyday life. The functionality of Beats begins with the wireless Bluetooth connection and continues with drivers and speakers that relay the audio to the user. There are a number of other specialized functions such as noise cancelling and personalized spatial audio that also change user experience. The process begins with the AAC codec and H1 Bluetooth chip pairing with the desired device. The H1 chip also plays a role in decoding compressed audio via AAC from the connected device, as well as enabling specialized functions such as noise cancelling (Katz, 2024). The integrated digital processor then receives the decoded audio signal from the H1 chip and creates the sound profile using binary sequences. These binary sequences are then transformed into electrical signals that can be utilized by the drivers and speakers to produce audio. (Digital Technologies Hub, 2024). This audio is then controlled and mitigated by the earpads and volume controls.

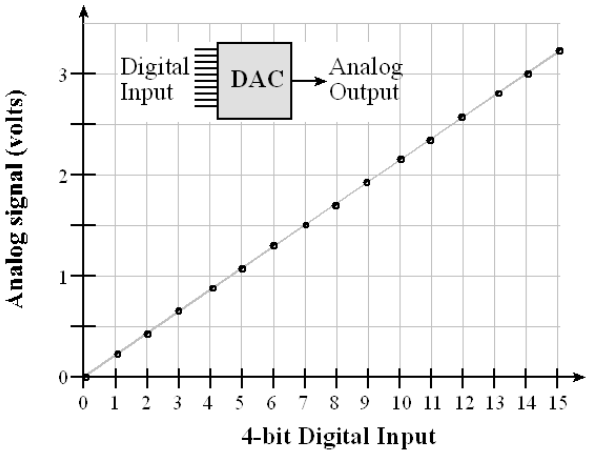

Figure 3. Analog signal in volts (output) based on the binary digital input

Conclusion

In conclusion, Beats aim to deliver high quality audio to users with a simple yet customizable approach, focusing primarily on functionality and easiness to use. Beats are immensely popular, recording 46% of total dollar sales for wireless headphones in 2016 (Richter, 2017). Due to rises in popularity for other Apple products, this number has probably fallen but is certainly still remarkable. Typically, as a type of product is available for longer periods of time, the price generally falls. In America, tariffs on imported goods might lead to rises in the price of Beats in the near future. While wireless headphones such as Beats are remarkable pieces of technology, irresponsible use can lead to hearing loss, so they should be used responsibly. It's also beneficial to listen to the sounds of the real world as well!

References

Beats Studio Pro - Premium Wireless Noise Cancelling Headphones. (n.d.). Beatsbydre.com. https://www.beatsbydre.com/headphones/studio-pro-wireless

Einstein, B. (2015, June 18). *How It's Made Series: Beats By Dre - Ben Einstein - Medium*. Medium. https://beneinstein.com/how-it-s-made-series-beats-by-dre-154aae384b36

Triggs, R. (2023, February 13). *Explained: What do the Apple H1 and H2 chips do?*. Android Authority. https://www.androidauthority.com/apple-h1-h2-chips-979713/

Richter, F. (2017, Feb 8). *Infographic: The U.S. Wireless Headphone Market*. (n.d.). Statista Infographics. https://www.statista.com/chart/7993/headphone-market-share/

Katz, L. (2020, January 22) *Understanding Bluetooth codecs*. SoundGuys. https://www.soundguys.com/understanding-bluetooth-codecs-15352/

Digital Technologies Hub. (2024). *Representing audio in digital systems*. Digital Technologies Hub. https://www.digitaltechnologieshub.edu.au/teach-and-assess/classroom-resources/lesson-ideas/representing-audio-in-digital-systems/

Valvano J, Yerraballi R. (2020). *Embedded Systems - Shape The World*. University of Texas at Austin https://users.ece.utexas.edu/~valvano/Volume1/E-Book/C13_DACSound.htm#:~:text=If%20we%20connect%20headphones%20to%20this%20DAC%2C,a%20sequence%20of%20data%20to%20the%20DAC.&text=If%20you%20output%20a%20sequence%20of%20numbers,the%20speaker%2C%20as%20shown%20in%20Figure%2013.8.