February 2022

PCB Layout for Improved Mechanical Performance of Earbuds

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ABSTRACT

This disclosure describes layout modifications in PCBs to provide improved impact performance for wearable devices. Specifically, techniques described herein can be utilized to improve the mechanical performance of the PCB solder joint. Oversized inner layer pads are added that are connected to the surface layer pads with vias, which serve as rivets to anchor the surface pads down. The inner layer pads are held down by utilizing copper floods of the surface layer to further improve robustness. Thicker, redundant traces are added to the bottom surface layer as well as the inner layer. The described techniques can provide an in-ear wearable device that is more resilient and offers improved impact performance, e.g., works reliably even after being dropped.

KEYWORDS

- Earbuds
- Headphones
- Printed Circuit Board (PCB)
- Vertical interconnect
- Vertical Interconnect Access hole (via)
- Impact performance
- Microphone
- Failure rate
- Solder joint
- Solder pad

BACKGROUND

Audio playback devices such as headphones or earbuds are increasingly being built with smart features. These devices are in-ear computing devices that, besides audio playback, can perform various functions such as noise cancellation, fitness tracking, wireless communication, medical monitoring, etc. They are designed to tight specifications due to their computational requirements and the limited space available as a device worn inside or over the human ear.

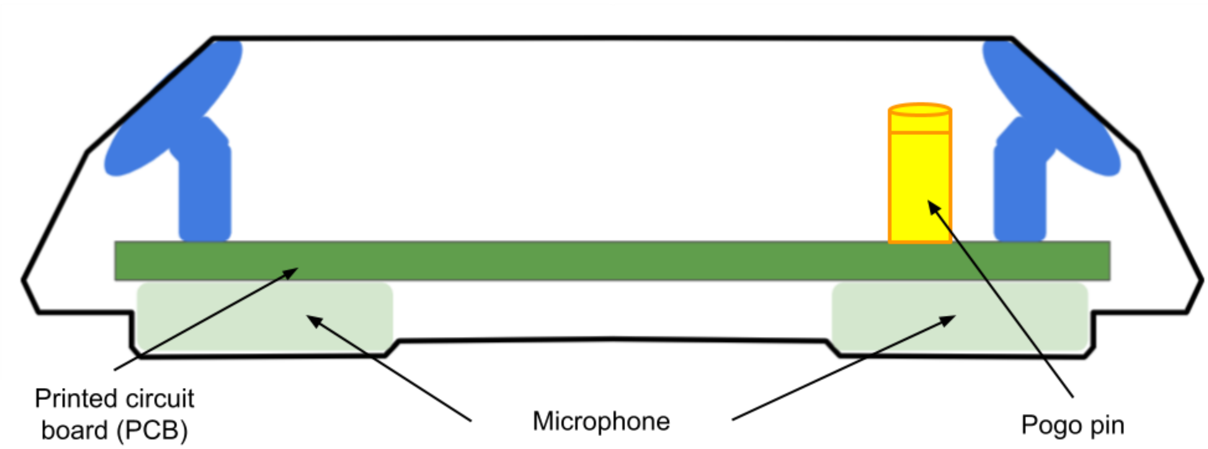

Fig. 1: Wearable audio device

Fig. 1 illustrates a wearable audio device, with built-in microphones. As depicted in Fig. 1, the microphones are placed adjacent to a printed circuit board (PCB) on which various electrical components are mounted. A pogo pin connector is also depicted that provides electrical and/or signal connectivity to the PCB. The placement of the microphones results in significant mechanical stress to the microphones during impact, e.g., if the device is dropped. The pogo pin can further increase the stress applied to the microphone that is located proximate to the pogo pin. The applied stresses can lead to solder pad damage and/or microphone failure.

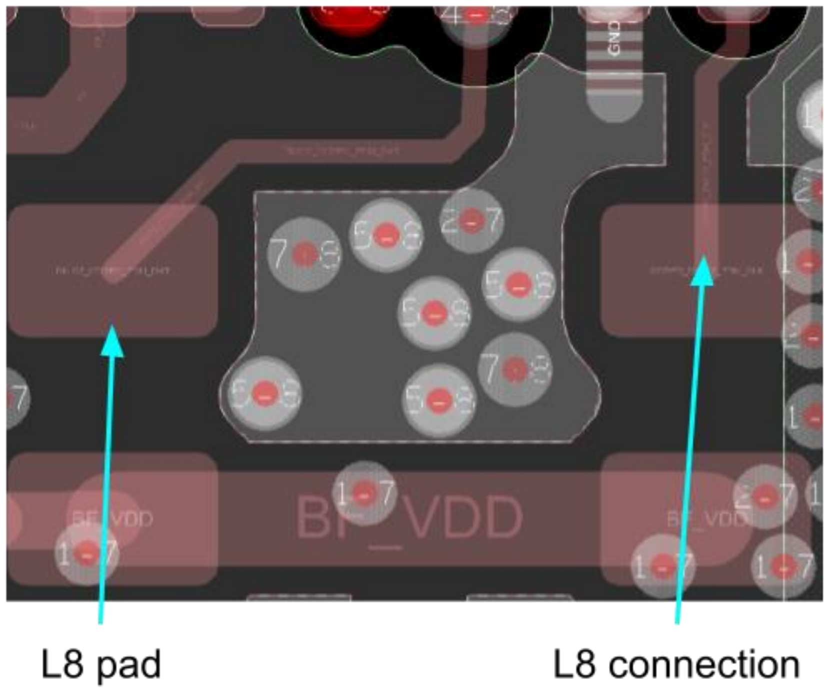

Fig. 2: Layout of an example layer (L8) of a printed circuit board

Fig. 2 depicts an example layout of a layer of a multi-layer PCB, such as may be used in such devices. In this illustrative example, an L8 (layer 8) layout is depicted. As depicted in Fig. 2, the L8 layer includes a pad - an exposed region of metal that is utilized to solder component leads. Fig. 2 also depicts a L8 PCB trace (connection/track) that conducts signals along the surface of the PCB.

DESCRIPTION

This disclosure describes layout modifications in PCBs to provide improved impact performance for wearable devices. Specifically, techniques described herein can be utilized to improve the mechanical performance of the PCB solder joint.

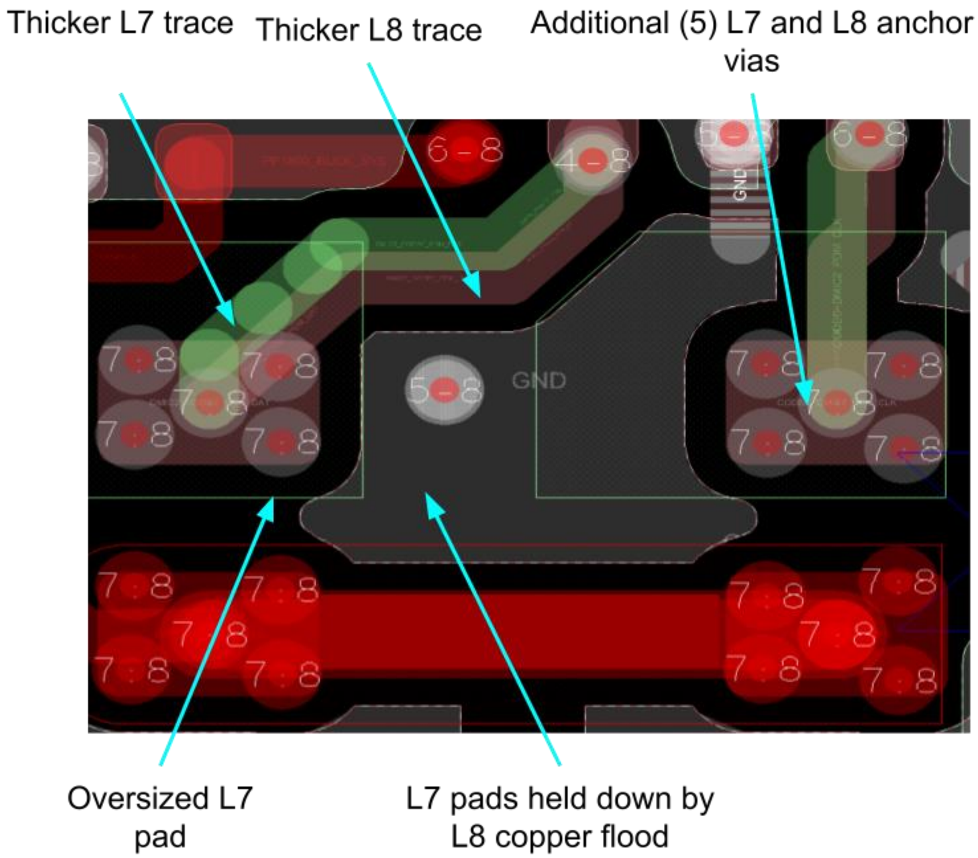

Fig. 3: Layout modifications in L7 (green) and L8 (brown) for improved solder joint performance

Fig. 3 depicts layout modifications that can achieve improved mechanical performance of the solder joint, per techniques of this disclosure. In this illustrative example, a surface layer (L8) and an inner layer (L7) of an eight-layer PCB are depicted. Modifications to the L7 layer are depicted in green while modifications to the L8 layer are depicted in brown. The layout modifications include:

- Addition of oversized inner layer (L7) pads. The inner layer pads are connected to the surface (L8) pads with vias, which serve as rivets to anchor the surface pads down.
- The oversized inner layer (embedded) pads are held down by utilizing copper floods of the surface layer (L8) to improve robustness.

- Thicker, redundant traces are added to the bottom surface layer (L8) as well as the inner layer (L7).

Techniques of this disclosure can be utilized in any electronic product where additional PCB pad robustness is needed, while meeting tight space constraints and at relatively lower costs. In particular, they can provide an in-ear wearable device that is more resilient and offers improved impact performance, e.g., works reliably even after being dropped.

CONCLUSION

This disclosure describes layout modifications in PCBs to provide improved impact performance for wearable devices. Specifically, techniques described herein can be utilized to improve the mechanical performance of the PCB solder joint. Oversized inner layer pads are added that are connected to the surface layer pads with vias, which serve as rivets to anchor the surface pads down. The inner layer pads are held down by utilizing copper floods of the surface layer to further improve robustness. Thicker, redundant traces are added to the bottom surface layer as well as the inner layer. The described techniques can provide an in-ear wearable device that is more resilient and offers improved impact performance, e.g., works reliably even after being dropped.