

APPLICATION NOTE 4449

How to Pick a Click-and-Pop Suppressor

Abstract: This application note presents the MAX9890 and MAX9892 which use different approaches to remove audible click and pop from headphones. Each device is uniquely suited to different applications.

Introduction

Click-and-pop suppressors are unique devices that can be added to a system late in the design process to eliminate click-and-pop issues without substantially changing the design. Two devices, the [MAX9890](#) and [MAX9892](#), are primarily focused on eliminating clicks and pops from headphone playback systems. The devices reflect different approaches, and thereby solve click and pop generated at different times and by different sources in the design.

The Series-Switch Method of the MAX9890

The MAX9890 (**Figure 1**) only addresses click and pop that originates from output-coupling capacitors. Many headphone playback systems rely upon DC-blocking capacitors to couple the headphone amplifier to the transducer. In these systems the main source of click and pop is the charging and discharging of the coupling capacitors at turn-on and turn-off. Capacitors in the 100 μ F to 330 μ F range are typically used. The "pop" resulting from charging such capacitors is generally quite large.

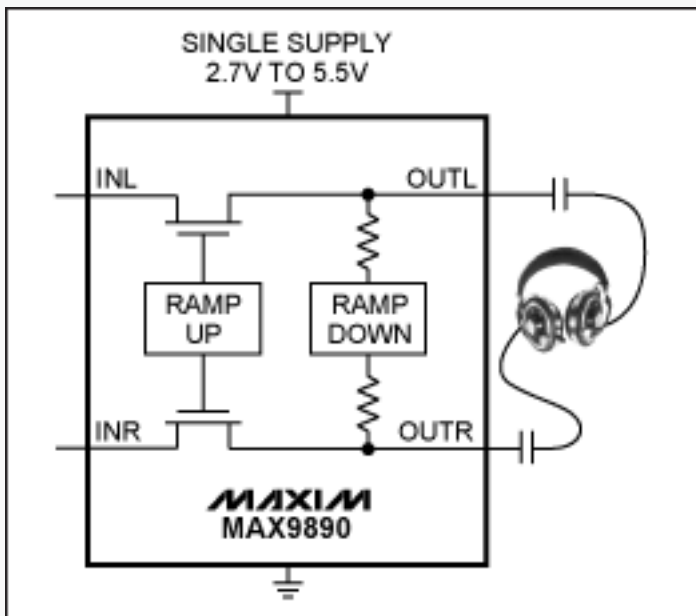


Figure 1. MAX9890 click-and-pop suppressor.

To address the click and pop caused by coupling capacitors, the MAX9890 allows the capacitors to charge and discharge slowly, at a rate below the audible frequency range. To do this, the MAX9890 is placed between the amplifier and the coupling capacitors. At turn-on the device uses two analog switches to slowly apply the DC bias from the headphone amplifier to the capacitor. At turn-off, resistors are then used to slowly discharge the coupling capacitors.

This series-switch method of the MAX9890 quite effectively eliminates click and pop caused by coupling capacitors; it does nothing for other sources of click and pop. In addition, this approach assumes a low impedance to ground through the headphone transducer at the output side of the coupling capacitor. Consequently, the design does not work effectively for line outputs where the expected load is typically greater than 10k Ω .

The Shunt-Mode of the MAX9892

In systems either where the source of click and pop is not output-coupling capacitors or where the output is a line output, then the MAX9892 is the ideal solution. The MAX9892 places a switch between each output and ground, causing the power-up and power-down transients to be shunted to ground. While the switches are closed, the output is completely muted, eliminating all clicks and pops.

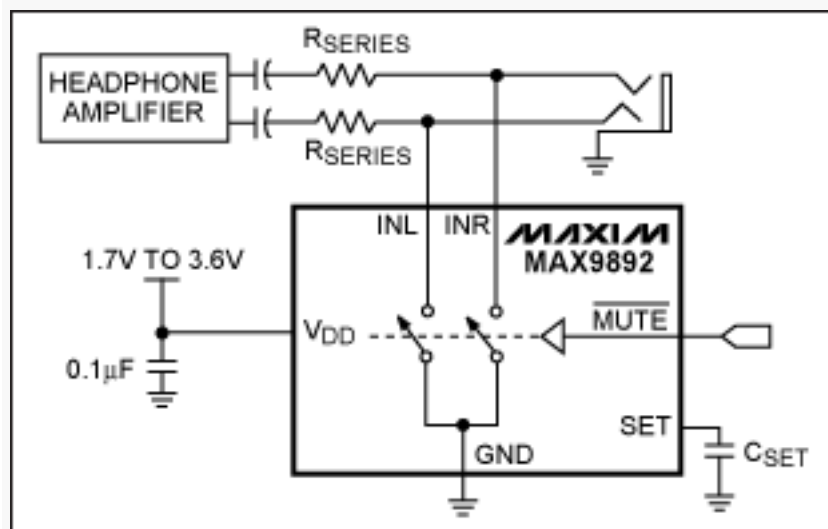


Figure 2. MAX9892 click-and-pop suppressor.

To achieve sufficient attenuation, the MAX9892 requires series resistors between the amplifier and the jack. Combined with the MAX9892's switches, these resistors create a voltage-divider on the output that attenuates any clicks and pops generated by the amplifier. When the click and pops are finished, the MAX9892 can be disabled and will have no impact on the output signal.

Conclusion

There are multiple devices to suppress audible click and pop in designs. The devices function differently, so not every IC is ideal for every application. When selecting a click-and-pop suppression device, ask the following basic questions to determine which device is best for the design. Is the expected load headphones? Is the charging of coupling capacitors the only source of click and pop in the system?

If the answer to both questions is yes, then the MAX9890 is the ideal solution to eliminating click and pop. In all other cases, the MAX9892 will provide the best results.

Application note 4449: www.maxim-ic.com/an4449

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