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Eliminate Clicks When Muting Single-Ended Audio

IT'S EASY TO mute a balanced signal line. Simply short the terminals or break the signal path. But when the line is unbalanced (single ended) and the output has strong dc bias, trying to mute the circuit with these methods will affect the output's bias voltage, producing tremendous "clicks" in the output due to the sudden change.

A simple addition that preserves the dc bias while shorting the ac signal allows muting without clicks. The example shows the muting circuit for a condenser (electret) microphone with integrated single-ended preamplifier *(see the figure)*. While it might be easier to simply short the preamplifier's input terminals to mute the circuit, in this case they are not accessible. Even if they were, however, placing a switch at the preamplifier input would run a high risk of picking up ambient electrical noise.

The muting circuit only requires four components: a resistor (R), a capacitor (C), a diode (D), and the switch (Sw). When the microphone circuit has power, capacitor C charges until it reaches the output bias voltage. With the switch in the "Mute" position, the capacitor short-circuits the audio signal. With the switch in the "Work" position, the capacitor has little effect on the signal as long as the RC time constant is long relative to signal frequency and the signal does not go above the diode's forward voltage.

Moving the switch from "Work" to "Mute" shorts across R. But because the capacitor is charged, there is essentially no voltage across R. Thus, there is little or no change in the output's bias voltage and no click results. Only the bias change that might result would come from voltage across R due to leakage current in C, so the capacitor should offer low leakage.

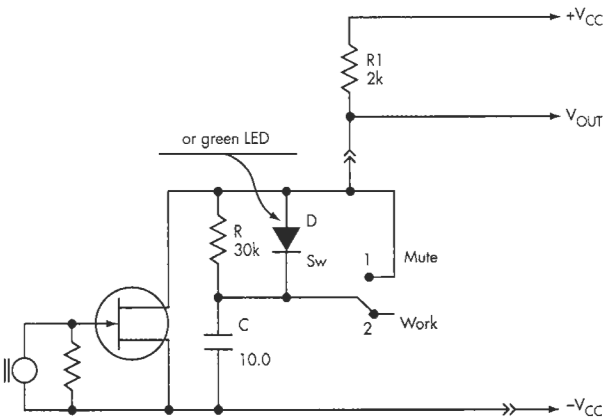
To effectively mute all signal frequencies, the value of C should be properly selected:

$$C >> 1/(2 \times \Pi \times f \times R1)$$

where f is the signal's frequency. To avoid loss of gain, R should be much, much larger than R1.

The diode in this circuit is there simply to speed the capacitor's charge-up after power-on. It runs the risk of acting as a signal rectifier/limiter, though, if the signal's ac exceeds the diode's forward threshold. An LED can serve as an alternative to a simple diode to eliminate these effects. Any LED will work as long as its forward voltage is greater than the sum of dc bias and ac signal amplitude but less than V_{CC}.

Using an LED provides a no-cost benefit. It will flash during power-up to indicate that the line is okay. However, the flash is rather short and can occur unnoticed unless the LED is "super-bright."



By shorting only the ac component, this circuit can mute single-ended audio without generating "clicks" in the output.

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