# phase reversal: can an LM393 do this?

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I was tinkering with a circuit that I put together about a year ago. It listens to the tick tock of a clock using an 8 ohm transistor radio type speaker as a microphone. This circuit uses a single 5V supply. I have an LM741 with the + input biased at half of Vcc (2.5V... yeah I know already it's a sucky op−amp for that, but it's what I had on hand). The speaker is connected to both inputs differentially thru 3.3uF caps. Gain is set to 1000 using a 100K feedback and 100R input resistor on the − input. The output is fed thru a 47K resistor to an LM393 comparator's + input. The minus input is biased to about 1/2 Vcc but just a wee bit smaller than the value coming from the 741 so that its output idles high when no sound is being heard. The comparators output is positively fed back thru a .33uF cap and series 100K resistor. This makes the comparators output snap low and stay there for about 120mS after the sharp attack of the tick (or tock as appropriate) decays below the idle offset voltage between the comparators inputs. This all works well and fine, but.

Looking at the scope, with loud ticks, a mS or three after the output of the comparator snaps low, it instantly snaps high for a few mS and then back low again. The PIC chip trying to measure the spacing between ticks and tocks, doesn't like this. It seems that this happens when the output of the 741 exceeds a certain point. Apparently the 393 doesn't like its inputs coming too close to Vcc? Does this sound likely? The reason I suspect this is that I was able to cure the problem by placing some cool blue LEDs on the output of the 741 (before the 47K resistor). One LED between the output and Vcc, and one between the output and ground. The LEDs have a typical Vf of 3.3V, but both light dimly with the 2.5V applied. When the ticks (or tocks) occur, the LEDs flash brightly while keeping the output of the 741 between ~1.8V and ~3.3V above ground. No more funny "phase reversals" on the output of the 393 after that. The 393 didn't seem to care how near the voltage went to ground.

Sorry so long, but I want to be clear. :−)

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