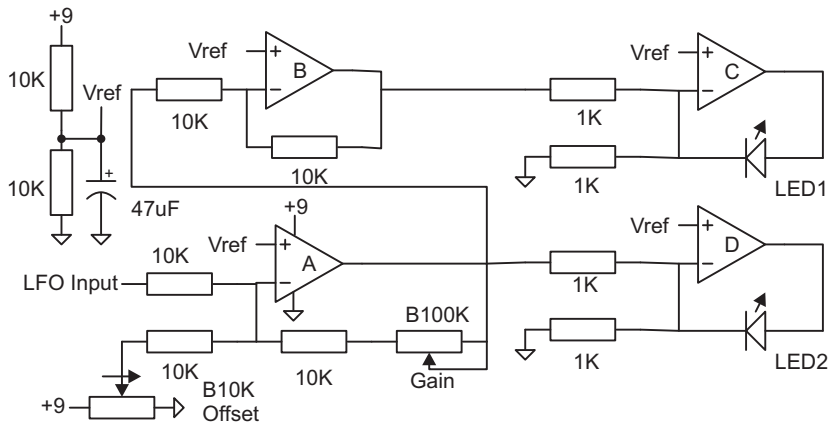


Out of Phase LEDs



This circuit takes an LFO input and converts it into lighting two LEDs. One LED gets brighter as the other gets dimmer, and vice versa.

The complexity is to allow it to be adapted to various previously-existing LFOs.

Opamps C and D drive the LEDs. The opamp is fed a current at its inverting input by a voltage on the 1K input resistor. The opamp output has to push enough current through the LED and 1K resistor to ground to balance, so a current of $(V_{ref} - V_{in})/1K$ has to flow in the LED. With the input at the 1K resistor at the same voltage as V_{ref} , the LED has half the maximum current flowing in it. This is the “mid position” corresponding to the incoming LFO being at V_{ref} , with zero-volt peaks above and below it.

Opamp B inverts the LFO signal that Opamp A produces, to drive one of the LEDs in the opposite direction from the other.

Opamp A adjusts the DC offset of the incoming LFO signal to put the LEDs at their “mid point” when the incoming LFO signal is at its mid point, and adjusts the size of the incoming LFO signal to give maximum swing to the LEDs for different incoming LFO signals.

This is important to match the LED minimum-to-maximum brightness swing to the minimum-to-maximum voltage swing of the incoming LFO signal. The incoming LFO can be as small as a volt or so, or may be several volts. The gain trimmer scales this so the LEDs are brightest at the peak and dimmest at the lowest point of the LFO. The incoming LFO signal may have a different DC level than V_{ref} . So the offset trimmer allows you to trim the DC level to the LEDs to get them to match the peaks and valleys of the incoming LFO signal, and not clip on either minimums or maximums. It also allows you to deliberately misadjust the response if you like that, too.

A single LM324 lets you do this in a single IC. You could use two dual opamps or four singles if you like. It is important that you pick an opamp which includes the negative supply at its input, and whose output pin will swing to ground. This often called a “single supply” opamp in the biz. Rail to rail opamps will work too. The opamp needs to have enough output current capability to drive LEDs directly to perhaps 10ma. The TI07x series will not work - its inputs and outputs can't swing to ground. The LM324 or LM2904 should work fine.