

# AC/DC Signal Mixer, Follower, Buffer and Inverter with 10 Inputs



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Often we want to add multiple AC/DC signals to produce the needed composite output signal. One such instance is when we want to add several audio signals for a home entertainment system, or when we wish to add several sinusoidal, triangular or rectangular signals. Another case is when we wish to add several arbitrary AC and DC voltages and produce a composite signal for testing purposes.

Here is a possible solution of a mixer and buffer working in the range of 0Hz to over 100kHz. The circuit can be used as part of audio equipment or as part of equipment for testing and measurement.

## Circuit and working

Fig. 1 shows a simple AC/DC mixer with 10 inputs. It is built around dual op-amp NE5532 or RC4560 (IC1) and a few other components. Each input can be used for AC or AC + DC signals. Inputs on connector CON1 (DC1 through DC10) are for AC + DC signals. Inputs on connector CON2 (AC1 through AC10) are for AC only signals.

Any combination of inputs can be used but every input has usage as

## PARTS LIST

### Semiconductors:

- IC1 - NE5532 or RC4560 op-amp
- LED1 - 5mm LED

### Resistors (all 1/4-watt, $\pm 5\%$ carbon):

- R1-R15 - 10-kilo-ohm
- R16 - 2.2-kilo-ohm
- R17 - 100-ohm

### Capacitors:

- C1-C10 - 0.1 $\mu$ F ceramic disk
- C11, C12 - 0.33 $\mu$ F ceramic disk
- C13, C14 - 220 $\mu$ F, 35V electrolytic
- C15 - 47 $\mu$ F, 35V electrolytic

### Miscellaneous:

- CON1, CON2 - 20-pin, 2-line female connector
- CON3 - 3-pin connector
- CON4-CON6 - 2-pin connector
- $\pm 9$ V DC power supply

AC only or as AC + DC input. All inputs have the same parameters and the gain of all inputs is unity.

Input resistance of all inputs is 10-kilo-ohm and these can be driven by ordinary operational amplifiers (OAs) and most signal sources without any problem. Resistors R1 through R10 can be changed to any appropriate value.

Integrated circuit RC4560/NE5532 has two operational amplifiers. The first op-amp A1 of IC1 is used as a summing and inverting amplifier for all inputs. The resulting signal that is the inverted sum of all input signals with the same weight in the sum is presented on output connector CON4. This signal is inverted by the second op-amp A2 of IC1 and the result is available on connector CON5.

This way, the

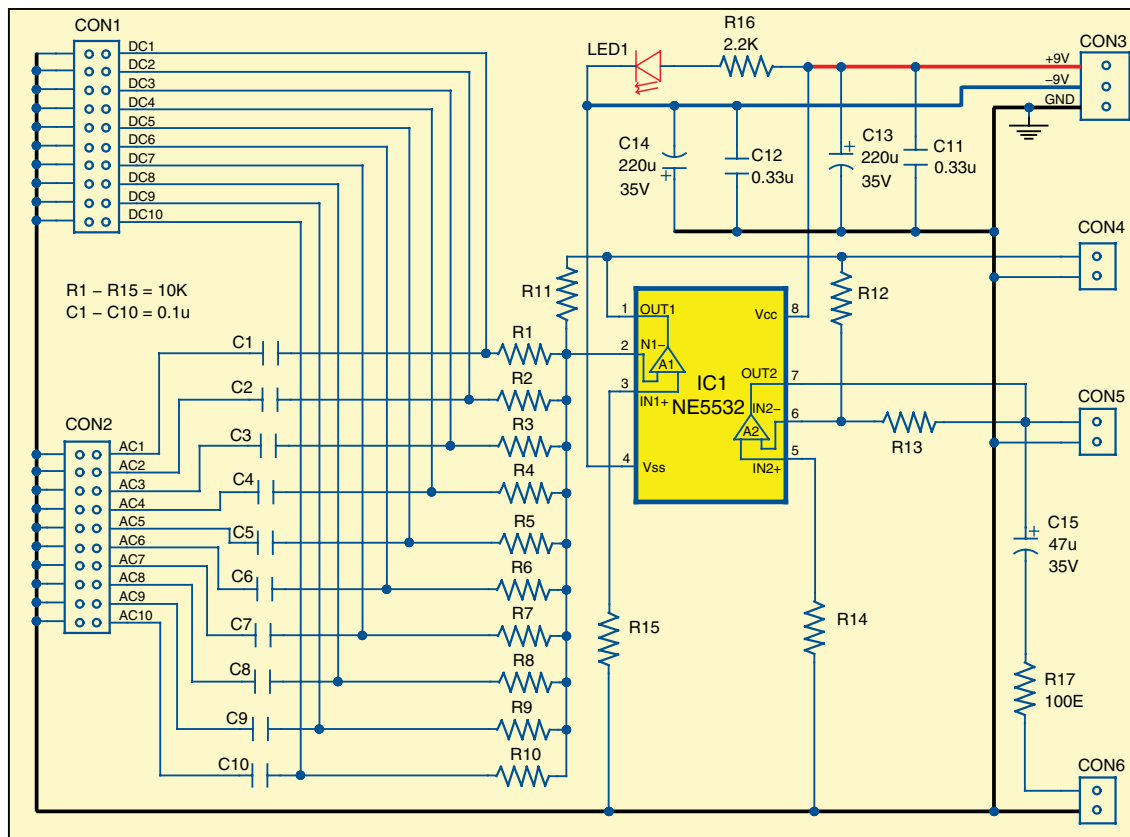


Fig. 1: Circuit diagram of the AC/DC signal mixer, follower, buffer and inverter with 10 inputs

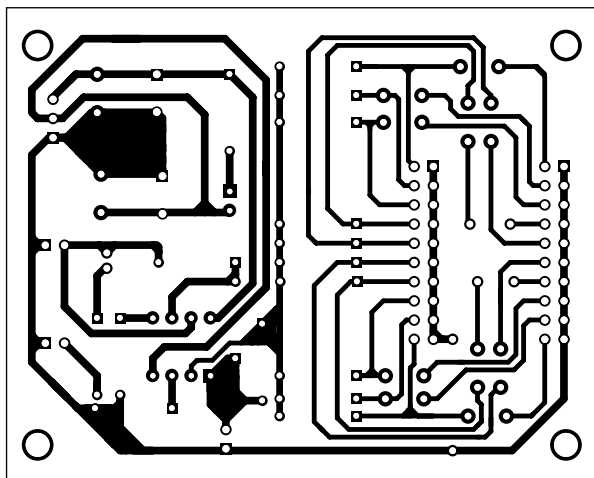


Fig. 2: Actual-size PCB of the mixer circuit

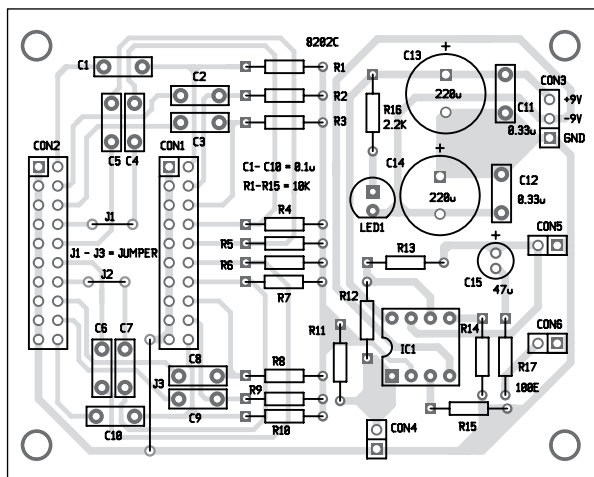


Fig. 3: Component layout of the PCB

circuit provides the inverted and the non-inverted sum of all input signals. Both outputs can be used simultaneously or individually. The outputs can drive loads as low as 400 ohms.

The DC component of the sum produced by second amplifier A2 is passed through DC-cutting capacitor C15 and is available on connector CON6.

The full power supply range of RC4560/NE5532 is available. This IC can work in the range of  $\pm 4V$  to  $\pm 18V$  (preferably up to  $\pm 15V$ ). The quiescent current without signal is typically less than 10mA.

We have tested the circuit on  $\pm 9V$  power supply. The circuit can also be powered using dry batteries, two 6V or 12V rechargeable accumulators or well-regulated mains power supply.

IC RC4560 can work with loads as low as 400 ohms and can drive audio lines directly. With IC NE5532 the loads should be 600 ohms or more. The power supply of NE5532 can go up to  $\pm 20V$  and if the load is 2-kilo-ohm or more, the output voltage swing will be larger than with RC4560.

Usage of IC OPA2134 is also possible and will produce excellent results. If TL072 or TL082 are used in the circuit, output loads should be 2-kilo-ohm or more. This circuit of a simple AC and DC mixer, follower and buffer with ten inputs can work with signals of 0Hz to more than 100kHz, with a large variety of operational amplifiers.

The mixer does not contain any expensive or rare components and will work immediately after its assembly, if done properly.

### Construction and testing

An actual-size, single-side PCB for the mixer circuit is shown in Fig. 2 and its component layout in Fig. 3. Enclose the PCB in a suitable small box such that connectors CON1 and CON2 can be used to connect ten inputs. Ensure proper wiring to avoid any mistake.

Panel-mount the input and output interface, as per requirement. ●

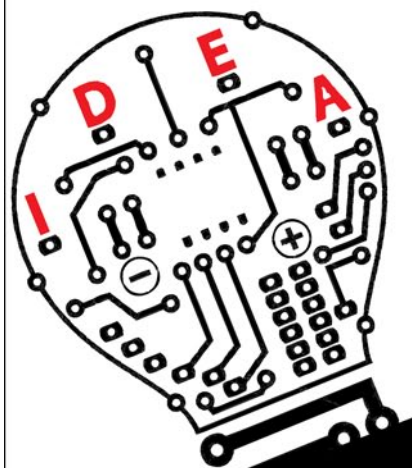
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