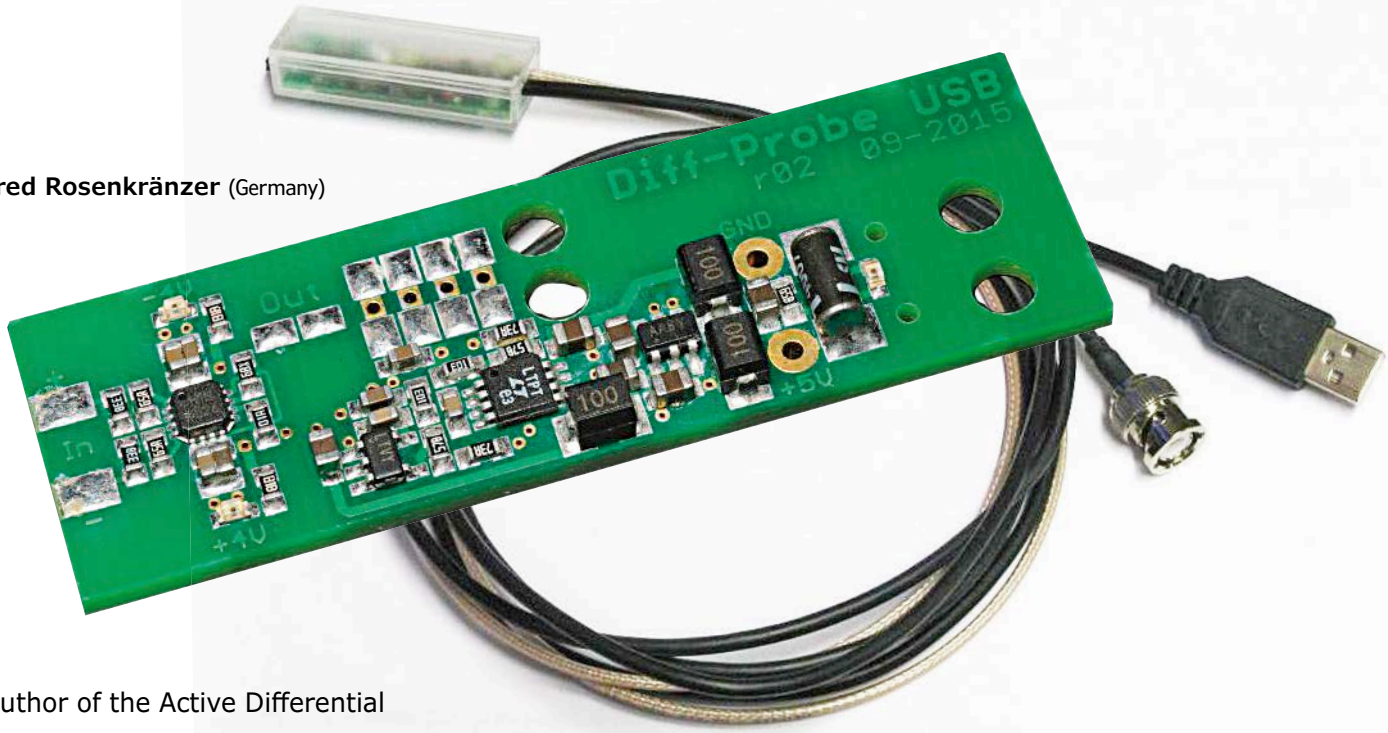
Active differential probe v2

Now USB-powered



By **Alfred Rosenkränzer** (Germany)

The author of the Active Differential Probe project (Elektor 4 2015 [1]) has developed a new version of this circuit, in which the supply voltage is now taken from a 5-V USB connection.

In **Figure 1** you can see the block diagram of the new power supply arrangements. After the 5-V supply from the USB connector has been filtered, a charge pump generates an unregulated negative voltage of (roughly) the same magnitude as the input voltage. Following some additional filtering, a negative low-dropout regulator brings this down to −4 V. A positive low-dropout regulator generates +4 V directly from the filtered USB supply.

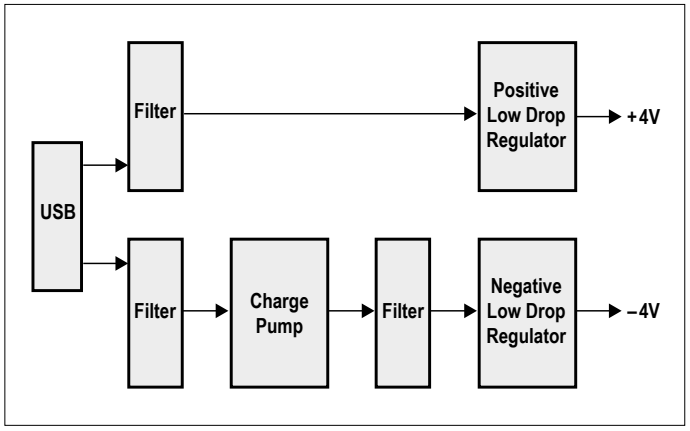


Figure 1. Block diagram of the new USB power supply arrangements.

Figure 2 shows the complete schematic. IC1, an LT1962EMS8, provides the stabilized positive supply voltage. The same function is performed for the negative voltage by IC2, an LT1964ES5. A MAX1697 (IC3) serves as charge pump.

Presence of the USB voltage together with the two regulated voltages is indicated by LEDs (D2, D3 und D4). Coils L1 and L2 take care of filtering the 'raw' USB voltage.

The circuitry of the differential amplifier (IC4) remains largely unaltered. Only the two series-connected input resistors on each input are each combined in a single module. This enables the op-amp to be moved forwards on the PCB, in order to make room for the power supply components.

In contrast to the schematic published in Elektor 4/2015, some alterations have been made. As non-isolated voltage converters have been used, the GND connection of the USB connection has been commoned with the signal GND.

Despite elaborate filtering, the clock frequency of the charge pump (around 200 kHz) is visible on a spectrum analyzer at < −80 dBm. On an oscilloscope it cannot be detected, however.

The last thing to mention is that the construction cost has risen, on account of the expensive regulators.
The project still fits in the USB case used previously and the BNC cable remains unaltered.

(150801)

For readers who may be interested the author offers ready-made probes. Info: alfred_rosenkraenzer@gmx.de.

Web Link

[1] www.elektormagazine.com/130538

Specifications

Attenuation:	10:1 with differential signal and 50 Ω termination
Differential input resistance:	5100 Ω, ±1%
Single-ended input resistance:	2550 Ω, ±1%
Input common mode range:	±12 V
Output resistance:	50 Ω, ±1%
Bandwidth:	approx. 1.9 GHz (−3 dB)
Rise/fall time:	300 ps
Power supply:	USB 5 V, approx. 70 mA

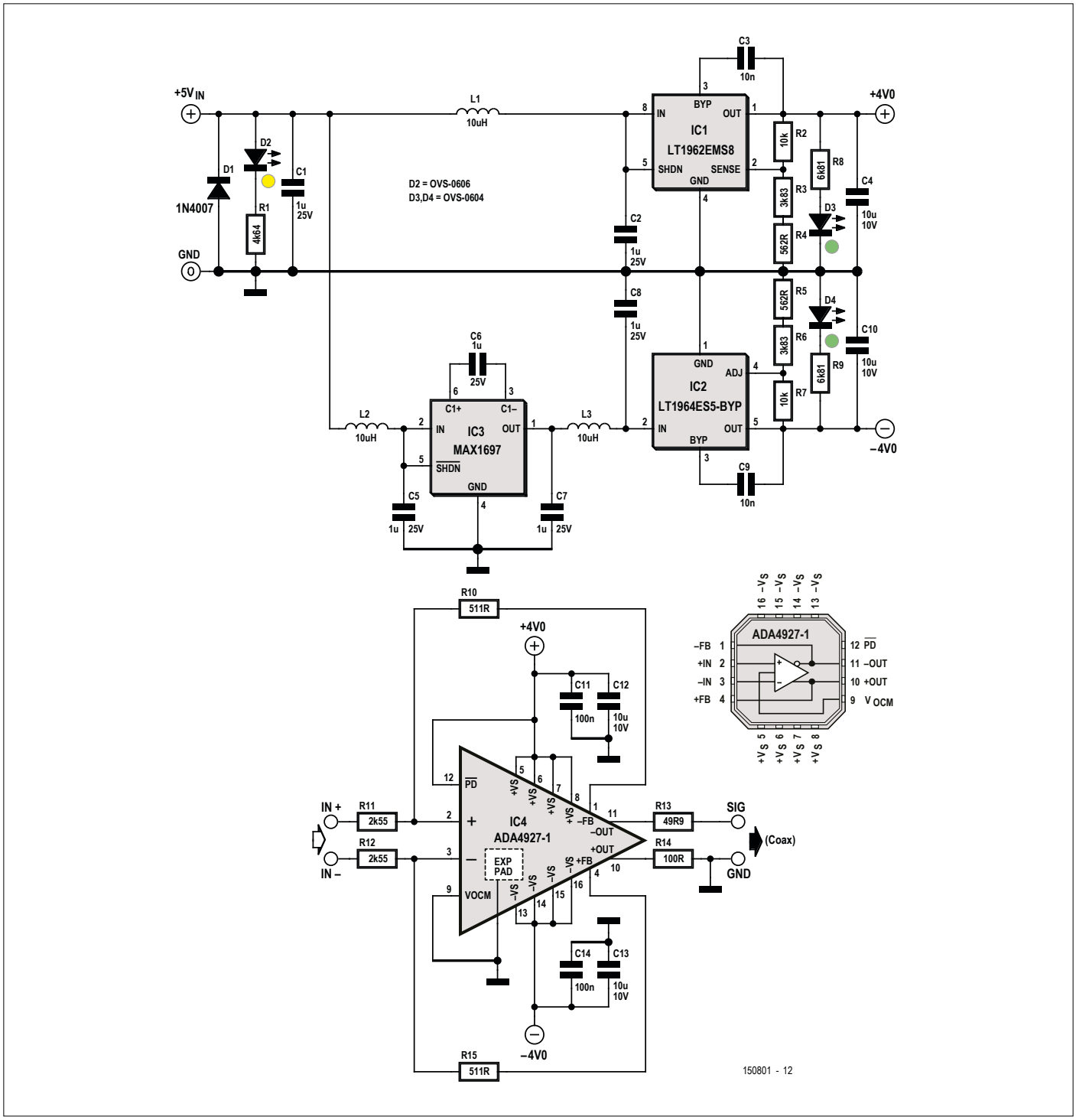


Figure 2. The complete schematic. The section surrounding the differential amplifier (IC4) is fundamentally unaltered.