KITS EDUCATIONAL ELECTRONIC

AVT 733

Battery watchdog

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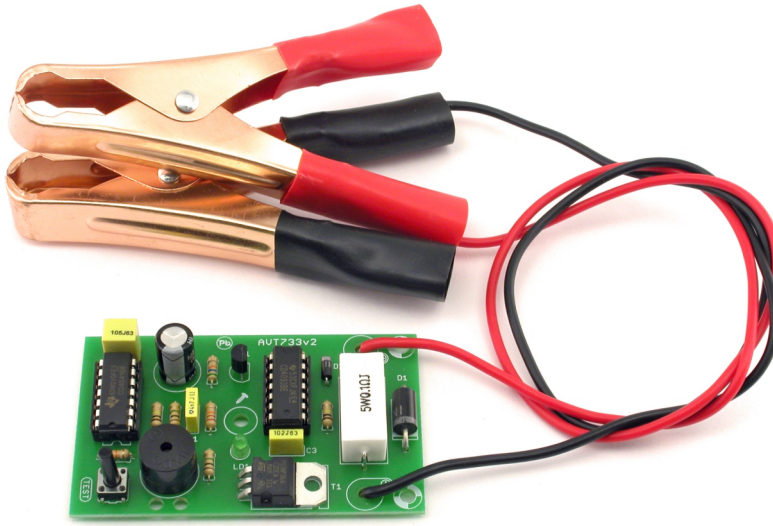

Simple dual-function device: - controls the battery voltage and signals the need for charging, thus securing the battery and improving the performance of the battery that is not working by burdening it with short current pulses. The system permanently attached to the battery terminals continuously controls its condition.

Specifications

- compatible with lead acid batteries (also gel) with 12V voltage
- low-voltage signaling
- battery condition signaling with LED
- adjusted threshold voltage
- power supply 12V from the monitored battery

Functional description

The schematic is shown in Figure 1. The CMOS 4541 (U1) integrated circuit works as an astable generator. The pulse occurring every minute at the pin 8 produces a positive pulse with a duration of about 1 second on the R9 resistor. At the same time the low state appearing at the output of gate U2A (pin 3) activates the voltage measurement circuit with VR1 chip – TL431. If the supply voltage is higher than the level determined by the divider consisting of resistors R3 and R4, the U3 integrated circuit conducts and current flows through the R5 resistor (the negative pulse appears on the U3 cathode with a duration as determined by the C2-R9 circuit). A negative pulse causes the U2D gate to change and the green LED lights up for about 1 second, which signals the correct battery voltage. The U2B gate does not change because the U3 cathode pulse keeps its output high. The falling edge at the cathode U3 produces a short pulse on the resistor R6. Elements R6 and C3 determine the duration of this pulse – approximately 100 microseconds. A pulse of this length occurs on the gate of the MOSFET T1 transistor and causes the transistor to be fully open. From the battery, through a diode D1, a resistor R7 with a resistance of 0.1 Ohm and through the transistor T1 flows through this short time a powerful current pulse.
If the battery voltage is lower than the voltage determined by the divisor R3 and R4, the impulse with the length determined by the capacitor C2 and the resistor R9 between the anode and cathode of the VR1 integrated circuit does not flow. There will be no voltage drop on R5, so at VR1 cathode there will be no negative pulse – there will be continuous high state.
The S1 key is connected in the programming input of the 4541. Normally, the low logic levels are present at inputs A and B (pin 12, 13).

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Pressing S1 decreases this factor to 256. Normally pulses at Q output (n. 8 U1) occur every minute and several dozen seconds. By pressing the S1 button, the pulses will occur every 2 seconds. This is a manual test mode and if the battery voltage is correct, the LED LD1 will light up every 2 seconds for about 1 second, and at too low a buzzer will sound similarly.

Due to the impulse work, in the power supply circuit the diode D2 and the capacitor C4 are needed. Although the average current consumption is small, it is essential to ensure that this circuit is operated in a very good contact with the battery terminals.

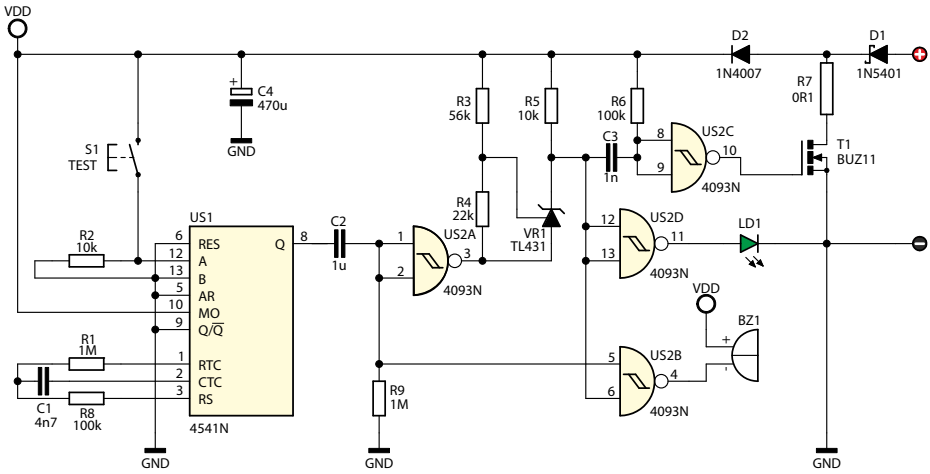

Figure 1. Schematic diagram

Assembly and test

During assembly the polarity of the components (electrolytic capacitors, transistors, diodes) should be noted. After completing the assembly, the polarization of the components on the PCB and the short circuiting of the soldering points should be carefully checked. A faultlessly assembled system with efficient components will work properly.

The battery watchdog can be checked with power supply with an adjustable output voltage. To do so, press the S1 button permanently. At a voltage above 11V should flash the green LED, while at lower voltage should be emitted sound every 2 seconds. The threshold voltage, considered as the discharging limit, is about 11V and is determined by 5% resistors R3 and R4.

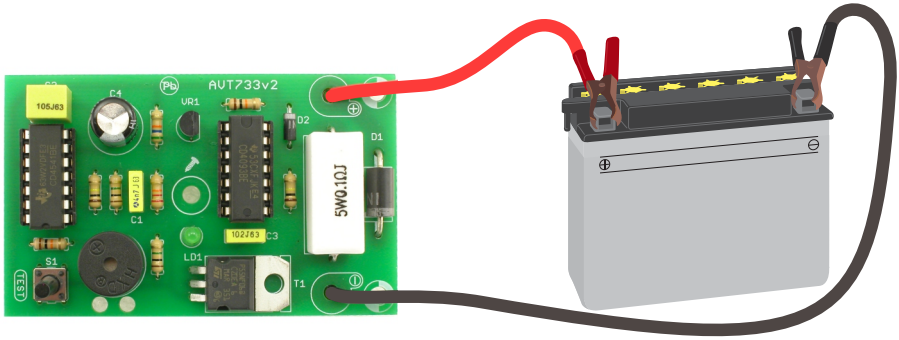

Figure 2. Connection example

Start off by soldering the printed circuit elements in order from smallest to largest. The unit assembled flawlessly, using the supplied components will operate immediately after switching on the power supply.

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Component list

Resistors:
R1, R9:.....1MΩ (brown-black-green-gold)
R2, R5:.....10kΩ (brown-black-orange-gold)
R6, R8:.....100kΩ (brown-black-yellow-gold)
R3:.....56kΩ (green-blue-orange-gold)
R4:.....22kΩ (red-red-orange-gold)
R7:.....0,1Ω/5W (0R1 or brown-black-silver-gold)
Capacitors:
C1:.....4,7nF (marked as 472)
C2:.....1µF (marked as 105)
C3:.....1nF (marked as 102)
C4:.....100-470µF !
Semiconductors:
D1:.....1N5408 !
D2:.....1N4007 !
T1:.....BUZ11 or similar !
VR1.....TL431 !
LD1:.....LED diode (GREEN) !
US1:.....CMOS 4541 with 14-pin IC socket !
US2:.....CMOS 4093 with 14-pin IC socket !
Others:
IS1:.....switch
BZ1:.....buzzer with generator 12V !
Crocodile clip 2pcs.

While assembling the components marked with an exclamation mark attention should be paid to their polarity. Symbols of the components on the PCB as well as photos of assembled sets may come in useful. To access high-resolution images, download the PDF file.

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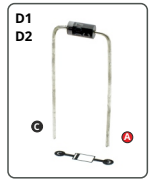
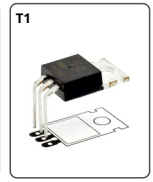
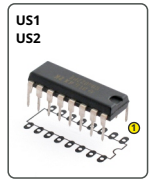
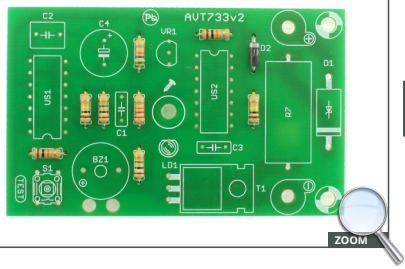




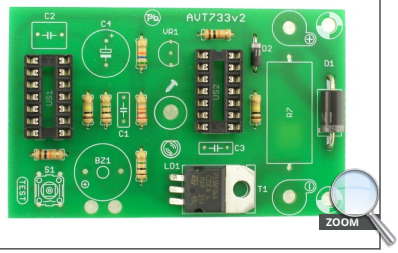


Assembly in 5 steps

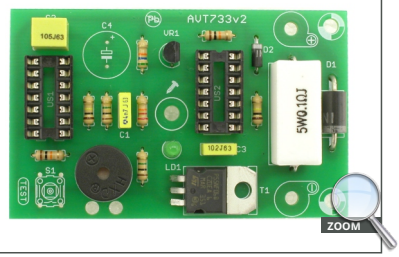
1 Solder resistors R1-R9 and diode D2



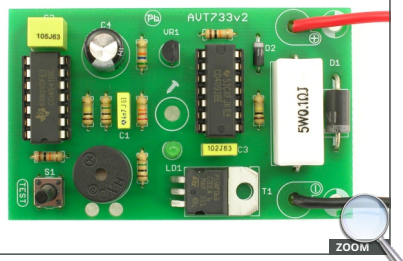
2 Solder IC socket, transistor T1 and diode D1



3 Solder capacitors C1, C3, LED diode LD1, VR1, resistor R7, buzzer BZ1 and capacitor C2



4 Solder capacitor C4, switch S1 and wires insert chip into socket



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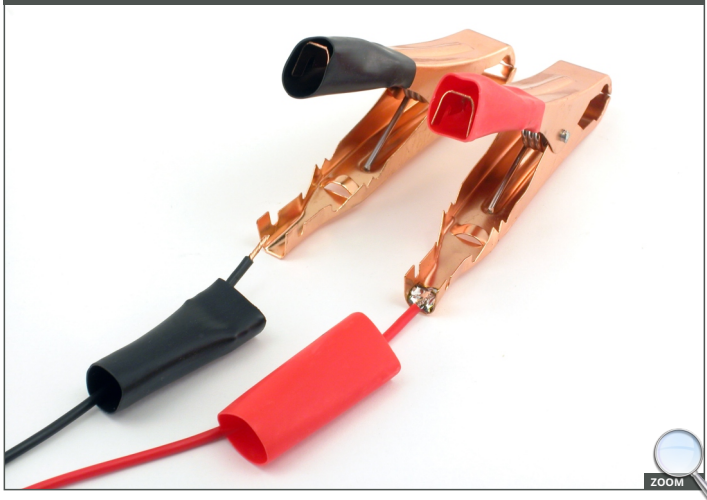
5 Solder the crocodile clip cables



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• Battery or wall-adaptor are safe devices. They do not require special attention unless main voltage is connected to an output e.g. a relay.
• If the kit is used to switch currents greater than 24V it is necessary to have the installation and performed by a trained professional authorized for such work. The kit may only be used in such application if it was installed in a safe to touch enclosure.
• Never exceed the limits or ratings listed in the 'Specifications' section at the this user guide.
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• The product itself and all parts thereof (including packing material) are not suitable toys for childern! (choking hazard, risk of electric shock, ...)

Failures in modern electronic component are very rare as 95% of non-working kits are due to poor soldering or components placed in the wrong location or orientation so please check your work carefully.

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