

The thermometer measures the temperature between -55°C and $+125^{\circ}\text{C}$. It was built exclusively with THT components and a ready-made waterproof temperature sensor.

Specifications

- temperature range $-55...+125^{\circ}\text{C}$
- LED display update every 2 seconds
- waterproof sensor based on DS18B20
- does not require adjustment or calibration
- power supply $7...15\text{V DC}/0.3\text{A}$

Functional description

Schematic of the thermometer with LED display is shown in Figure 1. The device should be supplied with DC voltage within range from 7 to 15V connected to the POWER connector. It can be any DC power supply unit with 0.2A load current or more. Diode D1 protects device from faulty input polarity. Input voltage is applied to voltage stabilizer U1. Microcontroller U2 (ATtiny2313) is responsible for all functionality of the thermometer.

DS1820, DS18B20 or DS18S20 is used as temperature sensor. Individual sensors differ in their resolution and software driver.

The microcontroller software automatically detects the type of connected sensor after switching power on. The result of temperature measurement is displayed on the 4 digit LED display. Bipolar transistors T1...T4 are supplying anodes of the LED digits while cathodes are directly driven from microcontrollers outputs via limit resistors R6...R13. The first position of the LED display shows a minus sign, if the measured temperature is less than 0. The maximum resolution of the temperature measurement is 0.1°C . The measurement result is updated every 2 seconds.



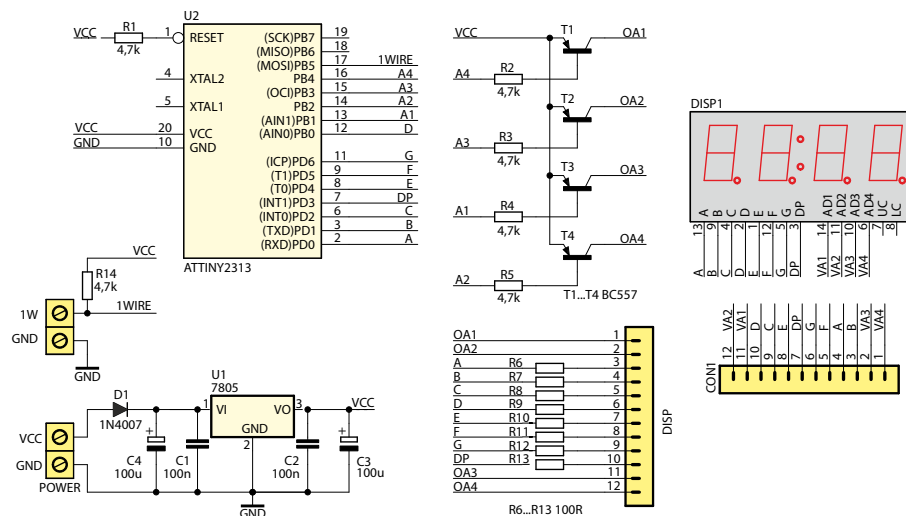


Figure 1. Schematic diagram

Assembly and test

The assembly is typical and should not cause the problems. It runs in standard way starting from the smallest components and ending with the largest ones. After assembling both PCBs should be connected together with the angled goldpins.

The next step is to attach the temperature sensor. For this purpose use a screw connector mounted on the PCB: the yellow sensor cable is connected to the 1W pin the black and red cables are shorted and connected to the pin marked GND. The way of attaching a temperature sensor is shown in Figure 2.

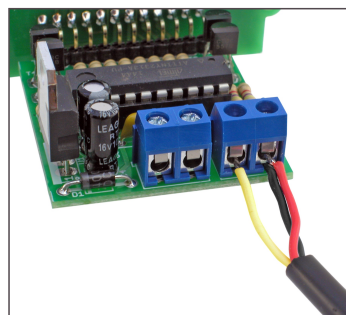
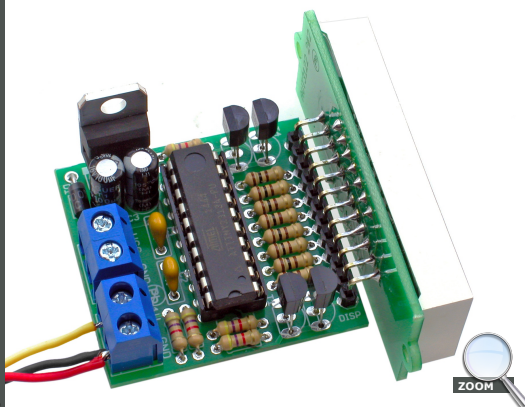


Figure 2. How to connect the sensor



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.

Component list

Resistors:

R1–R5, R14:.....4,7kΩ (yellow-violet-red-gold)
R6–R13:.....100Ω (brown-black-brown-gold)

Capacitors:

C1, C2:.....100nF (also marked as 104)
C3, C4:.....100μF !

Semiconductors:

D1:.....1N4007 or similar !
T1–T4:.....BC557 (BC558) !
U1:.....7805 !
U2:.....ATtiny2313A with 20-pin IC socket
U3:.....DS18B20
DISP:.....LED–AF5643

Others:

goldpin connector 14pin
VCC:.....2-pin terminal block connector
1W:.....2-pin terminal block connector

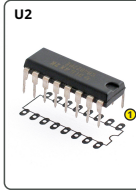
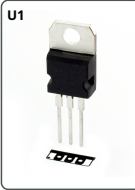
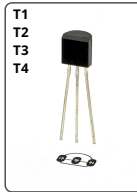
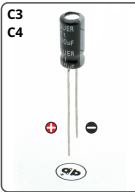


While assembling the components marked with an exclamation mark attention should be paid to their polarity. Symbols of the components on the PCB as well as photos of assembled sets may come in useful. To access high-resolution images, download the PDF file.

<http://bit.ly/2yT2Pxo>

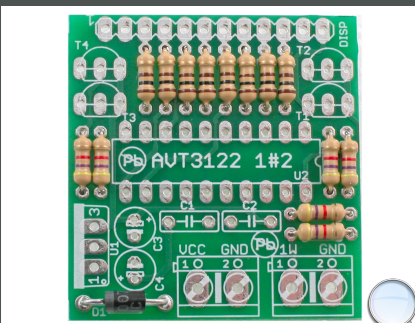


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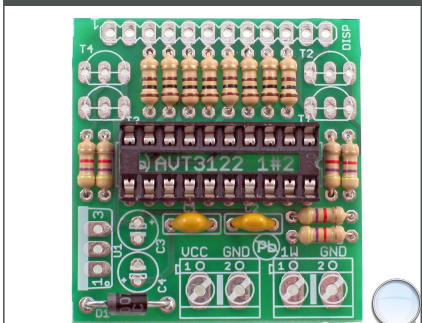


Assembly in 4 steps

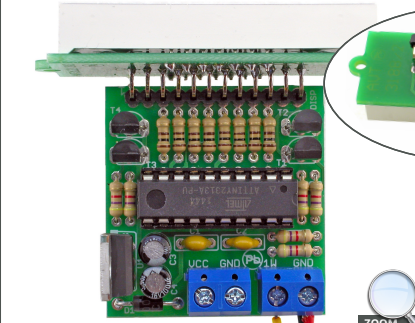
1 Solder resistors R1–R16 and diode D1



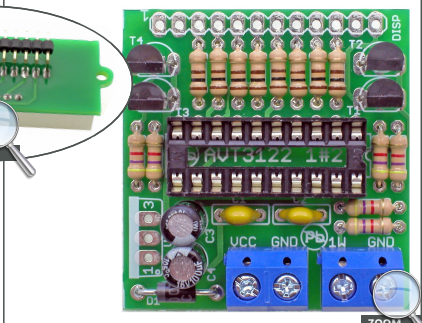
2 Solder capacitors C1, C2 and IC socket



4 Solder capacitors C3, C4, U1, and LED display with PCB, insert chip into socket



3 Solder transistors T1–T4, PIEZO and connectors. Solder LED display and goldpin connector



AVT 3122

Thermometer with LED display

DIFFICULTY
LEVEL





EDUCATIONAL
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AV1 SPV reserves the right to make changes without prior notice.

Assembly and connection of the device not in accordance with the instructions, unauthorized modification of components and any structural modifications may cause damage to the device and endanger the person using it. In this case, the manufacturer and its authorized representatives shall not be liable for any damages arising directly or indirectly from the use or malfunction of the product.