

1) State the advantages of protoboards.

- quick assembly of electrical circuits from standard components,
- easy to make changes to the schematic,
- the resulting circuit can be easily connected to an oscilloscope, power supply, signal generator, etc.,
- low price.

2) State the disadvantages of protoboards.

- unprofessional appearance,
- higher probability of incorrect connection of components because there is no computer assistance,
- large parasitic capacitances and inductances,
- great difficulties or even the impossibility of working with SMD components,
- production in large series is not possible,
- constructing large schematics becomes problematic.

3) State the advantages of printed circuit boards.

- professional appearance,
- enables the design of compact electric circuits,
- less parasitic capacitance and inductance,
- it can be applied in power electronics,
- enables the design of electric circuits at high frequencies,
- easy to assemble and reproduce.

4) State the disadvantages of printed circuit boards.

- drastically increased time it takes to get from the finished schematic to the final product,
- higher development costs,
- the impossibility of changing the electrical circuit once the printed circuit board is made,
- it is necessary to master some software tool for designing printed circuit boards,
- good PCB design software tools are expensive.

5) Routing rules for power lines.

- wide lines,
- lines as short as possible,
- star structure,
- avoid sharp corners.

6) Routing rules for signal lines.

- as short as possible,
- typically the same width as integrated circuit pins (~10 mils),
- avoid sharp corners.

7) Express 1 inch (1") in cm.

1" = 2.54 cm.

8) Types of components according to the mounting method on the printed circuit board.

- through hole components,
- components for surface mounting on a printed circuit board (SMD).

9) State the parameters of the resistor.

- casing type,
- resistance [Ω],
- power [W].

10) State the parameters of the capacitor.

- casing type,
- capacity [F],
- maximum allowed voltage [V].

11) State the reasons and methods of capacitors use on power supply lines of integrated circuits.

Capacitors are used to filter interference and store energy near the integrated circuit, and they are placed as close as possible to the power pins of the integrated circuit.

12) What are via used for?

Via are used to join two or more layers of copper.

13) List the general features of Circuit Maker.

- the younger brother of Altium Designer,
- intended for the Open Hardware community,
- cloud system,
- requires an internet connection,
- free of charge.

14) Draw the shape and indicate the dimensions of the resistor in the 0603 case.

15) What is the disadvantage of a solder (wave) bath and how can it be solved?

- can only be used if SMD components are placed on the top side of the board,
- this problem is solved by using selective soldering machines with a nozzle or by gluing the components to the board.

16) How are the components placed on the printed circuit board?

- manually,
- semi-automatic,
- automatic (pick & place machine).

17) What is the function of flux in soldering?

To clean impurities and allow solder to adhere to copper.

18) What is the role of diffuse forces when soldering SMD components?

- centering of components during soldering,
- attraction of components to the copper on the printed circuit board.

19) What are the most common problems with SMD components in reflow soldering and why do they occur?

- Short circuit connections (solder bridge - bridging) - occur due to an excessive amount of solder,
- Manhattan effect (tombstoning) - occurs in cases where, in a two-ended component, the solder on one end melts before the solder on the other end. Because of this, the surface forces acting on one end weaken, and the component straightens to one side.

20) Give examples of soldering wire in the food industry and outside it.

- the use of lead in the food industry is prohibited - Sn96Ag3.8Cu0.7,
- for other applications, solder wire with lead can still be obtained - Sn60Pb38Cu2.

21) Explain what the CTRL + M shortcut is used for in Circuit Maker.

The shortcut is used to measure the distance between two points on the printed circuit board.

22) List which measurement systems are supported in Circuit Maker?

- metric,
- imperial.

23) Explain what the shortcut L is used for in Circuit Maker.

The shortcut is used to switch the component between the top and bottom layer of the printed circuit board.

24) Explain what the shortcut F is used for in Circuit Maker.

The shortcut is used to change the view of the printed circuit board between the bottom and top view.

25) List the types of graphic representation of the printed circuit board and the shortcuts used to call them.

- 2D view – is called by pressing key 2,
- 3D view - called by pressing the key 3.

26) Explain the role of the commands right click + drag, CTRL + scroll button, SHIFT + right click and 0 in 3D display of the printed circuit board.

- right click + drag – moves the panel in the opposite direction of the cursor drag direction,
- CTRL + scroll button - serves to zoom in on the printed board,
- SHIFT + right click – serves to rotate the printed board,
- 0 – resets the display of the printed circuit board in the xy plane.

27) Explain what the shortcut SHIFT + S is used for in Circuit Maker.

The shortcut is used to switch between Single and Multi layer mode.

28) Explain the role of top layer, bottom layer and multilayer.

The top and bottom layers are located on the top and bottom of the board and contain copper connections that connect the electronic components. Multilayer contains elements that look identical on all copper layers on the board.

29) Explain the role of overlay, paste and solder layer in the production of a printed circuit board.

- the overlay layer contains the names of designators, lines that mark the physical boundaries of the component, as well as other graphic elements that are used to describe the printed circuit board.
- the solder mask defines the area on which the protective varnish is applied and includes all surfaces on which solder is not applied,
- the paste mask is used to create the stencil and defines the openings under the component pads through which, in the manufacturing process, the solder paste is applied.

30) State the ranges of values that are most often used for R, L, C components on printed boards.

- L – mH,
- C – μF , nF, pF,
- R – Ω , k Ω , M Ω .

31) 10 pico is 10 to what power?

10^{-11}

32) What types of routing are there in Circuit Maker and what are they used for?

- interactive routing – used to set up individual lines,
- routing of differential pairs - used when routing differential signals, which are always placed in pairs and must be of the same length,
- interactive multi routing – used for bus routing when it is necessary to draw several lines at once.

33) What do gerber and NCdrill files contain and what are they used for?

Gerber files contain information about the layout of the conductive and non-conductive layers of the printed circuit board, while NCdrill files contain information about the positions and sizes of the holes to be drilled on the printed circuit board. PCB manufacturers use these files as a universal PCB design protocol so they don't have to support the various file formats used by different PCB design software.