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Radio Frequency Circuits Laboratory

Excercise 4
The SMD Technology and Protection Against Static Electricity

Aim of the exercise

The aim of this exercise is to get acquainted with the basic methods, equipment and elements used in surface mount devices technology (SMD), the reasons and rules for securing the electronic elements from electrostatic discharge, and soldering and desoldering the SMD elements.

Introduction

SMT/SMD

Surface Mount Technology (SMT) is based on placing and mounting specially adopted electronic elements on the printed board and connecting these elements to the path on the board without using the mounting openings. Introducing this technology is connected with the development of VLSI circuits. VLSI technology allows for placing very large number of elements on the board and as a result – decreasing the length of the connections. This technology and the possibilities it offers forced the manufacturers to introduce new mounting techniques. Production of Surface Mount Devices (SMD) caused fast development of SMT techniques and pushing out other mounting techniques.
Main Advantages of surface mount technology:

1. reduce the dimensions and weight of the printed boards that results from:
    - smaller dimensions and weight of SMD elements;
    - eliminating majority of mounting openings;
    - possibility of 2-sides mounting;
2. increase of the working speed of electronic circuits, better frequency characteristics resulting from decrease of transmission and triggering times;
3. possibility of automation of the mounting process;
4. increase of infallibility of the SMD elements (smaller number of internal connections, small dimensions and weight, larger resistance to vibrations and strokes);
5. cost reduction of manufacturing process of the electronic equipment resulting from easier automation of the manufacturing process, smaller dimensions and weight of the elements, smaller number of mounting devices, surface they occupy , operation and conservation costs, as well as simplification of process of preparing the production.

One-side surface mount process is completed in several steps:

1. Applying soldering paste on the places to be soldered using dosing machine, screen-print technique or transfer by special matrices with pills placed in particular places.
2. Placing the subassemblies in proper places using automatic manipulator X-Y coupled with the feeder with the speed of a dozen or hundreds thousands of elements per hour.
3. Positioning of elements with smallest raster of leads by the positioning machine supplied with vision system.
4. Soldering the elements using the reflow process in the special furnace or by heating the pairs of phosphohydrocarbons at the temperature 215˚C with the freon protection.
5. Cleaning soldered boards.
6. Checking the mounting correctness.

In case of 2-side mounting, the procedure is repeated after steps 1, 2, and 3 on the other side of the board. Sometimes it is necessary to stick the elements to the board to achieve the accurate positioning or to solder the non-standard subassemblies. Acrylic, cyanide-acrylic or anaerobic glues are used. The glue is placed on the board in the same way as the soldering paste. The cost of surface mount can e by 50% smaller than the cost of the traditional mounting process.

Elements used in SMT have small dimensions, small weight and reduced number of internal connections. They are more reliable than elements used in traditional through-hole mounting. SMT is simpler than the traditional method due to simple structure of SMD elements. There is no need for special preparation of the endings, simple packaging forms can be applied, and more efficient and less complicated mounting devices are used.

Electrostatic discharge protection

Get acquainted with the schemes presented below showing the methods of protecting the work standings from electrostatic discharge (ESD).

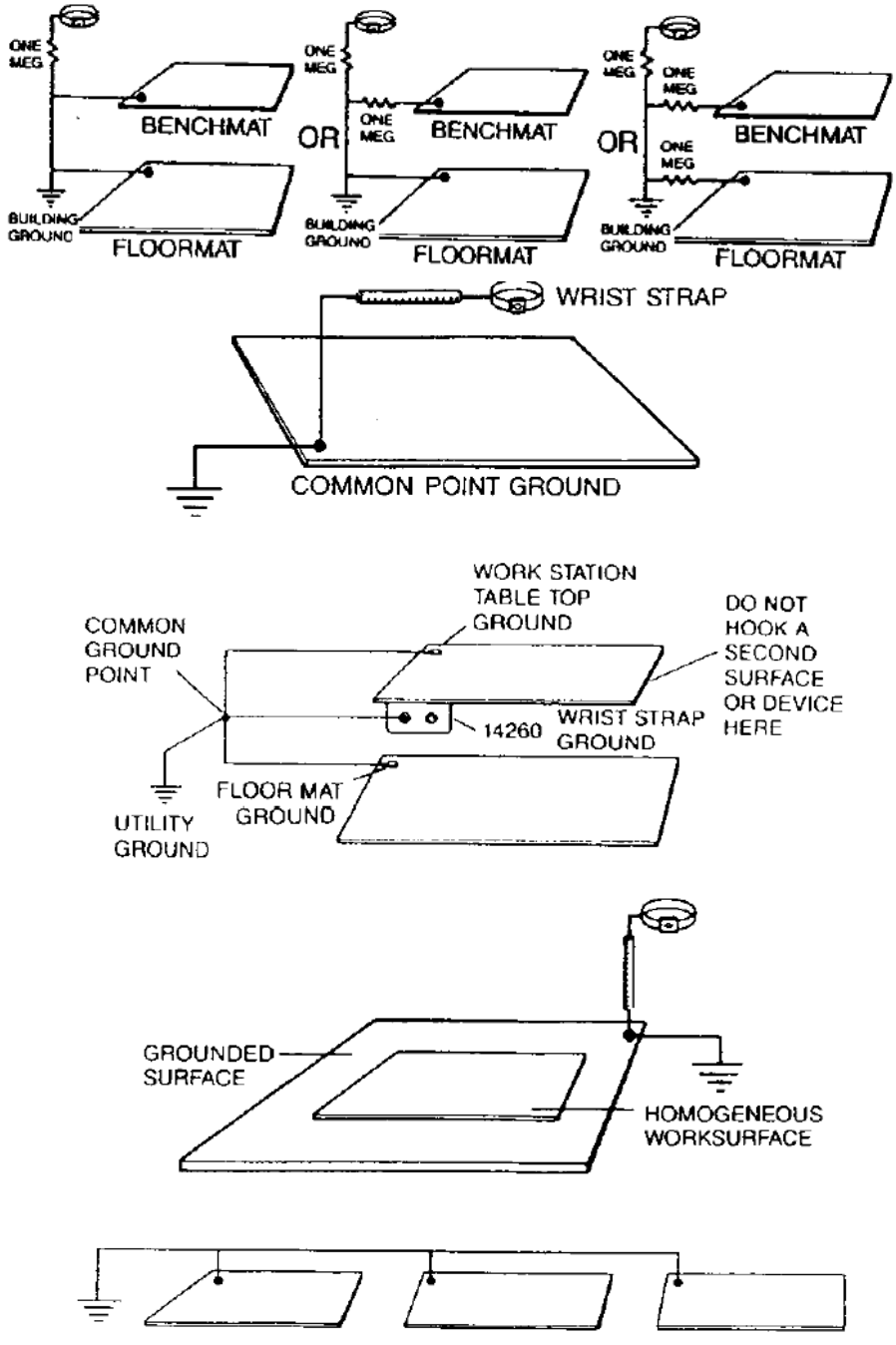

Fig. 1 Electrostatic discharge protection schemes

Experimental procedure

1. Identify the safety measures from electrostatic discharge in the laboratory and describe its structure.
2. Soak the sponges placed in the soldering station.
3. Get acquainted with the manual of the soldering station.
4. Turn on the soldering station Pace and connect appropriate soldering tool to perform mounting and demounting of SMD elements.
5. Install appropriate ending to the soldering tool. Use proper tools, such as grabs or positioning tools.
6. Adjust proper temperature values.
7. Desolder electronic circuit given by the teacher. If this is the high frequency amplifier, leave all BNC connectors and transistor on the board).
8. Solder the high frequency amplifier given in fig. 2 on the board given by the teacher. Make the coil by yourself using the silver wire. Follow the instructions given by the teacher.

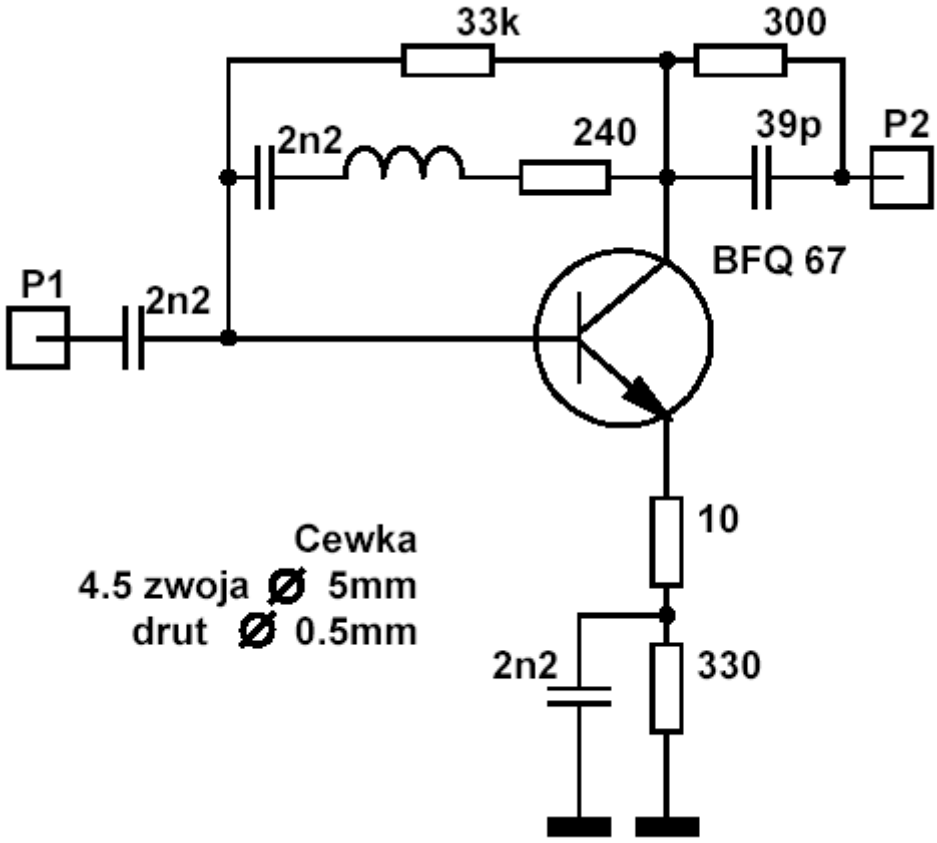

Fig. 2High frequency amplifier circuit