

Designing electronic circuit layouts using CAD tools

Overview

This standard identifies the competences you need to design printed circuit boards, semi-conductor layouts, or thick, thin or flexible film circuits, using computer-aided design (CAD) hardware and software tools, in accordance with approved procedures. You will be required to access the relevant design requirements and to extract all necessary information in order to carry out circuit layout operations. You will be required to use CAD tools to complete circuit layout designs, ensuring that the operational and designed for manufacture requirements are met. In your CAD design work, you will be expected to take into account all relevant fit, form and function aspects of the specified design, such as physical dimensions, materials to be used, position of circuit elements, access space for connectors/test points, connections between components and any special labelling.

Your responsibilities will require you to comply with organisational policy and procedures for the CAD activities undertaken and to report any problems with these activities that you cannot personally resolve, or are outside your permitted authority, to the relevant person. You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide a good understanding of your work and will provide an informed approach to applying design procedures for the circuit types described above. You will understand the CAD design process and its application and will know about the circuit production processes in adequate depth to provide a sound basis for carrying out the CAD design activities to the required specification.

You will understand the safety precautions required when using CAD equipment and tools. You will be required to demonstrate safe working practices throughout and will understand the responsibility you owe to yourself and others in the workplace.

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Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety legislation, regulations, directives and other relevant guidelines
2. follow relevant instructions and specifications for designs
3. produce designs that meet agreed requirements and timescales
4. check completed designs meet specifications
5. deal promptly and effectively with problems within your control and report those that cannot be solved
6. ensure that work records are completed, stored securely and available to others, as per organisational requirements
7. leave the work area in a safe condition on completion of the activities, as per organisational and legal requirements

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Knowledge and understanding

You need to know and understand:

1. the specific safety precautions to be taken whilst carrying out the activities (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)
2. the health and safety requirements of the work area and the activities, and the responsibility these requirements place on you
3. the hazards associated with the activities and how to minimise them and reduce risks
4. the personal protective equipment and clothing (PPE) to be worn during the activities
5. the methods and procedures used to minimise the chances of infecting a computer with a virus the potential damage that can be caused by computer viruses and procedures to follow to deal with viruses
6. the principles of electronic circuit layout design
7. how electronic circuit designs should embrace fit, form and function principles
8. the types of drawing that can be produced by the CAD software (component drawings, assembly drawings, circuit diagrams, schematics, block diagrams, wiring diagrams, circuit board designs)
9. the symbols and abbreviations used in the design process
10. how to set out the track designs
11. how to use the CAD equipment design packages and tools to assist with the circuit design processes (default settings and auto design rules)
12. the characteristics of the components and materials that are used in circuit designs
13. the manufacturing processes for making unpopulated electronic circuits and semi-conductor fabrications
14. the manufacturing processes for populating circuits with components and the processes used to finish the complete assembly
15. the difficulties that poor design can create for manufacturing processes
16. international guidelines/standards on good circuit layout practice
17. failure modes and effects analysis (FMEA)
18. how the finished circuit will be used by the customer
19. how to meet the requirements set out in the design specification
20. the organisational procedures, standards and guidelines to be followed for CAD-based electronic circuit design
21. how to access, recognise and use a wide range of standard electronic component symbol libraries from the CAD equipment
22. current national and international legislation, statutory and non-

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- statutory regulations, industry and national standards, industry guidelines and professional codes that apply to CAD-based electronic design activities
- 23. the extent of your own responsibility and whom you should report to if you have problems that you cannot resolve
- 24. how to access, use and maintain information to comply with organisational requirements and legislation

Scope/range related to performance criteria

1. Produce CAD circuit designs which meet all of the following requirements:
 1. the target dimensions of the circuit
 2. has built in test points (where applicable)
 3. can facilitate access for local repair/maintenance
 4. has appropriate connections required to/from the circuit
 5. uses pitches appropriate to the specified components
 6. has tracks of an appropriate thickness and width
 7. has appropriate separation between conductive tracks
 8. has bends in the tracks, of appropriate radius to the circuit requirements (such as speed, current)
 9. meets required signal integrity parameters (such as capacitance, inductance, resistance, insulation voltages, EMC/EMI)
 10. meets specified operating conditions (such as temperature, humidity, shock and vibration)
 11. takes account of component orientation
 12. takes into account any assembly schedule constraints (such as proximity of sensitive components to hot running items)
 13. takes into account any financial constraints on the type of circuit or components to be used
2. Produce designs for one of the following types of circuit:
 1. printed circuit board
 2. semi-conductor layouts
 3. flexible circuit
 4. thick film circuit
 5. thin film circuit
3. Produce one of the following circuit configurations:
 1. single sided
 2. double sided
 3. multi-layer
 4. flexi-rigid
 5. silicon wafer
4. Ensure the CAD design is compatible with one of the following production systems:
 1. re-flow or wave soldering
 2. hand soldering

3. semi-conductor die assembly
5. Check that designs comply with one of the following standards:
 1. organisational guidelines and codes of practice
 2. current industry standards and codes of practice
 3. CAD software standards
 4. other international standards

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