

# Course design of Design and Production of Printed Circuit Board Which Circuit Schematic Design is An Example

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**Abstract:** The course of Design and Production of Printed Circuit Board mainly includes five parts. This article designs the circuit schematic design module, mainly involving the design of the schematic drawing environment, placement of components, connection of components, editing of components, and post-processing of the schematic.

**Keywords:** Course, Circuit Diagram, Lesson Allocation, Teaching Methods.

## 1. Introduction

The course of Design and Production of Printed Circuit Board is the core course of the Electronic Information Technology. The pre courses include "Circuit and Electrician", "Analog Circuit Technology", "Digital Circuit Technology", "Microcontroller Application Technology", etc. The subsequent courses include "Design and Manufacturing of Small Electronic Products", "Application of Internet of Things Technology", graduation project, etc. Based on the importance of the course "Design and Production of Printed Circuit Board", it is urgent to further improve the course design of "Design and Production of Printed Circuit Board" according to the different needs of local enterprises. Furthermore, it is conducive to talent cultivation, cultivating more suitable skilled and technical talents for enterprises, and better providing certain talent needs for local economic development.

The course content of "Design and Production of Printed Circuit Board" mainly includes five modules, namely circuit schematic design, schematic original price library design, printed circuit board design, component packaging library design, and circuit board production. This article will take the module of circuit schematic design as an example to design the course content, teaching methods, and methods. The module of design of circuit schematic includes the design of the schematic drawing interface, placement of components, connection of components, editing of components, and post-processing of the schematic.

## 2. Design of Schematic Drawing Interface

### 2.1. Learning content

Before designing a circuit schematic, the first step is to design a drawing interface for the schematic, as shown in Figure 1. The main settings include the content in the "sheet options", which can include the type of drawing frame, drawing direction, title block content, design boundaries, borders, and working interface colors.

### 2.2. Class time allocation

Completing the teaching of this content is 2 classes.

### 2.3. Teaching method

This teaching content adopts a teaching method of learning while doing and integrating learning and doing. First, demonstrate the operation demonstration, as you are just starting to learn software operations and need to slowly explain and operate. Then assign corresponding tasks for this content and conduct operational learning.

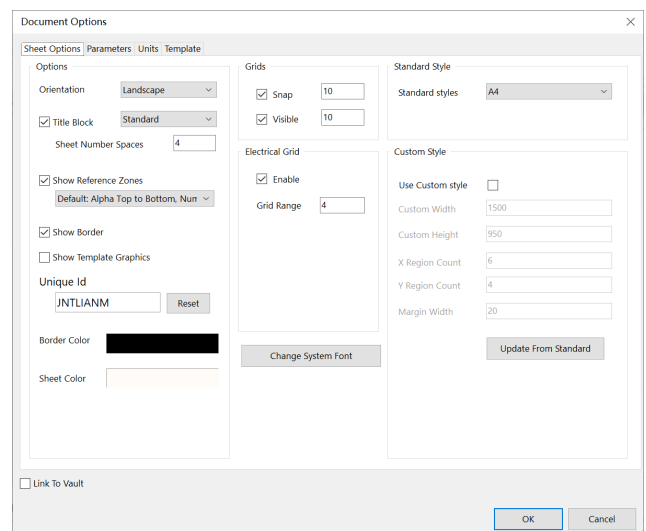


Figure 1. "Document Options" interface

## 3. Placing Components

### 3.1. Learning content

From the component library, as shown in Figure 2, select the required components and place them in the frame, as shown in Figure 3. Depending on the orientation requirements of the components, you can click the spacebar on the keyboard to rotate them 90 degrees. After placing the components, they need to be moved to the middle position of the frame.

### 3.2. Class time allocation

Completing the teaching of this content is 2 classes.

### 3.3. Teaching method

This teaching content also adopts a teaching method of learning while doing and integrating learning and doing. At the same time, incorporate a learning method of extrapolating from one example to another. All components in the component library are named in English. The teacher first introduces the identification and placement of several commonly used components, while students explore the names of other commonly used components to complete the corresponding placement.

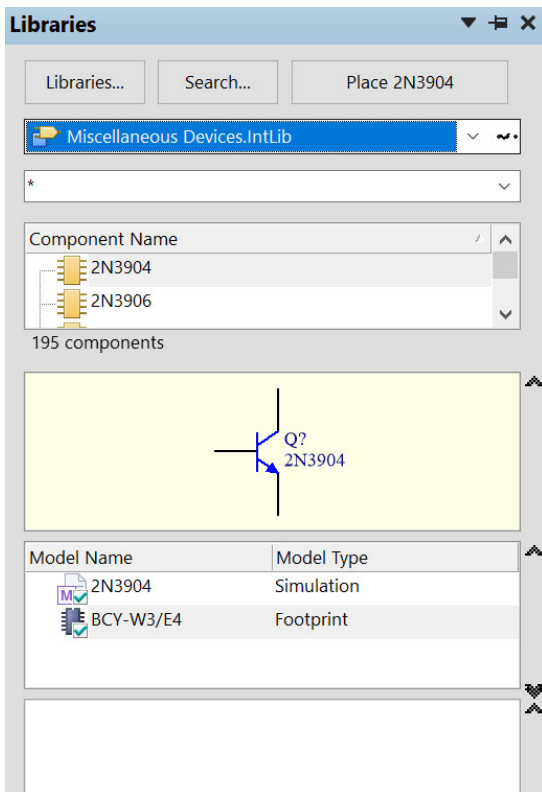


Figure 2. "Libraries" interface

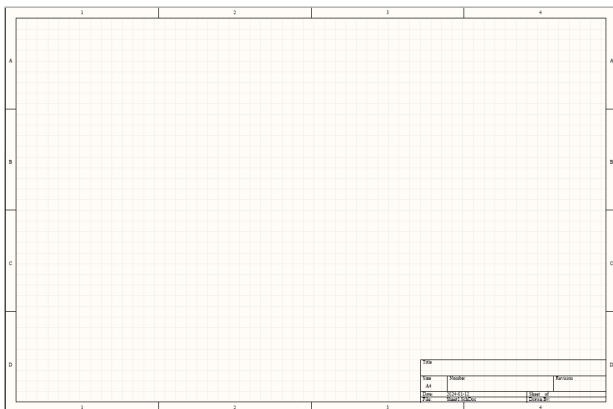


Figure 3. Schematic Frame

## 4. Connection of Components

### 4.1. Learning content

After placing the components, it is necessary to connect them according to the design requirements. Click on the first icon from left to right in Figure 4 to proceed with the operation. During the connection process, you can click the

"Tab" button on the keyboard to pop up a "Wire" window, where you can change the wire width and color, etc.

### 4.2. Class time allocation

Completing the teaching of this content is 2 classes.

### 4.3. Teaching method

This teaching content adopts a learning and doing integrated teaching method, while adding a flipped course approach. At the end of the last class, assign students tasks to self-study the connection of components. So in class, individual students are directly asked to demonstrate how to connect components. Students who have already mastered this knowledge will continue to complete other component connection tasks, while those who have not mastered it will receive separate guidance from the teacher for layered teaching.



Figure 4. "Wiring" toolbar

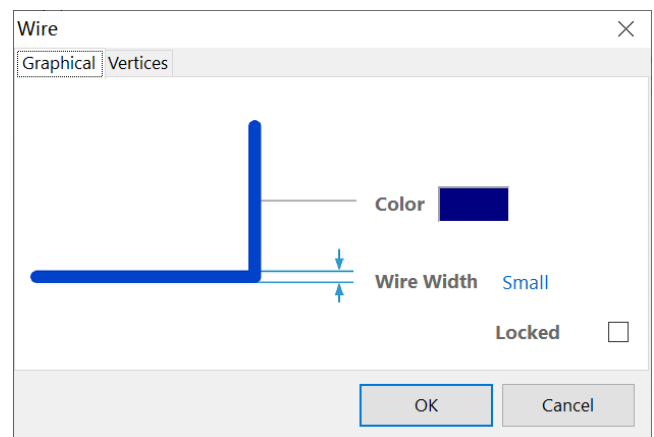


Figure 5. "Wire" interface

## 5. Editing of Components

### 5.1. Learning content

The components in Altium Designer have detailed attribute settings, including basic properties of the components, library information links, graphic properties, parameter settings, model settings, etc. Set the properties of the components according to the design requirements, as shown in Figure 6. The probability of using basic attributes is relatively high, including Designer, Comment, Description, Type, Unique Id, etc.

### 5.2. Class time allocation

Completing the teaching of this content is 2 classes.

### 5.3. Teaching method

This content adopts a teaching method of integrating learning and doing, while adding a teaching model of teamwork. Continuing from the previous courses on analog and digital circuits, under the guidance of the teacher, design the required component numbers, sizes, and corresponding packaging forms through group cooperation and research.

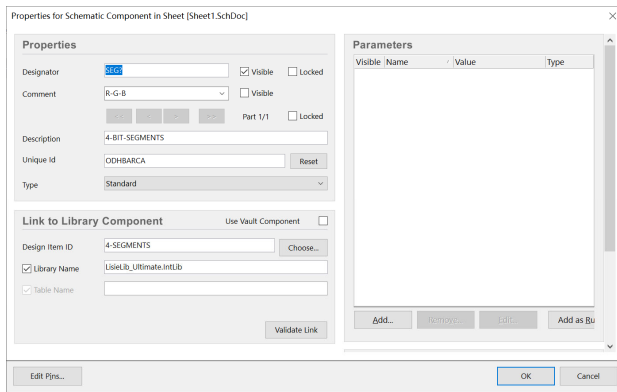


Figure 6. "Properties for Schematic Component in Sheet" interface

## 6. Post Processing of Schematic Diagrams

### 6.1. Learning content

Compile the project to meet the design conditions, and then print the corresponding schematic. Compilation engineering is used to check whether the user's design files comply with electrical regulations. After verifying the electrical connections of the circuit, reports such as network tables can be generated for the subsequent PCB production. After the schematic drawing is completed, it can be output through the printer for reference and backup by designers.

### 6.2. Class time allocation

Completing the teaching of this content is 2 classes.

### 6.3. Teaching method

This content adopts a teaching method of integrating learning and practice, and adopts a comment mode of self-evaluation, peer evaluation, and teacher evaluation at the same time.

## 7. Conclusion

This article takes circuit schematic design as an example to design the course of "Design and Production of Printed Circuit Board", including course content, class hour allocation, teaching methods and approaches. Setting different teaching methods and approaches for different course contents is beneficial for improving the quality of student learning and cultivating technical and skilled talents who can better serve local enterprises.

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## References

- [1] Xiaohe Yan. Curriculum reform of printed circuit board design and production. international journal of social science and education research. VOL1, NO.10, 2018: 8-11.
- [2] Eric A. Rodriguez, Brigitte C. Vanle, Jonathan A. Doorn et al. Hydroxylated and Sulfated Metabolites of Commonly Observed Airborne Polychlorinated Biphenyls Display Selective Uptake and Toxicity in N27, SH-SY5Y, and HepG2 Cells[J] Environmental Toxicology and Pharmacology, 2018
- [3] Xiaohe Yan. The Content of Creating PCB Component Footprints is designed and done. international journal of social science and education research. VOL3, NO.1, 2020: 63-67.
- [4] Xiaohe Yan, Zexiang Zheng and Yulin Tong. Design and practice of scientific research feedback course case—a case study of printed circuit board design and production. international journal of social science and education research. VOL4, NO.7, 2021: 86-90.
- [5] Xiaohe Yan, Zexiang Zheng and Yulin Tong. Curriculum reform and practice of printed circuit board design and production under the dual teaching of school and enterprise. international journal of social science and education research. VOL5, NO.4, 2022: 219-222.