高等学校专业英语教材

电子技术专业英语教程

冯新宇 主编 蒋洪波 陈晓洁 副主编

電子工業出版社
PUBLISHING HOUSE OF ELECTRONICS INDUSTRY
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北京·BEIJING

内 容 简 介

本书旨在使读者掌握电子技术专业英语术语及用法，培养和提高读者阅读和翻译专业英语文献资料的能力。全书由13个单元组成，内容涵盖电子及相关专业领域的主要技术分支。主要内容包括半导体器件、运算放大器、电源、电子仪器、线性电路分析、数字逻辑电路、集成电路、数字多媒体系统、电子系统、EDA工具、IC手册。每个主题单元由课文、阅读材料、课文词汇、课文注释和练习组成。本书书后附有课文参考译文、习题参考答案、科技英语写作要求等内容。为了方便教学，本书另配有电子教案及授课建议，向采纳本书作为教材的教师免费提供。

本书可作为电子技术等相关专业的专业英语教材，也可供从事相关专业的工程技术人员学习参考。

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前　言

专业英语教学的主要目的是培养和提高学生阅读本专业及相关领域的英语书籍、文献及科技英语写作的能力，使学生能真正地以英语为工具，获取专业的相关信息。

本书的编写以全面提高学生的阅读、分析和写作能力，扩展学生对本学科知识的认识为宗旨。教材内容力求反映 21 世纪电子技术等相关专业的发展，体现专业课内容更新快的要求。

全书由 13 个单元组成，内容涵盖电子及相关专业领域的主要技术分支。主要内容包括半导体器件、运算放大器、电源、电子仪器、线性电路分析、数字逻辑电路、集成电路、微型计算机、数字多媒体系统、电子系统、EDA 工具、IC 手册。每个主题单元由课文、阅读材料、课文词汇、课文注释和练习组成，其中课文和阅读材料着力体现该主题的核心关键技术，国外优秀科技成果，前沿领域及未来前景等，练习主要以 Summary 和 Keywords 为主，培养学生归纳总结能力。本书书后附有课文参考译文、习题参考答案、科技英语写作要求等内容。

为了方便教学，本书另配有电子教案及授课建议等，向采纳本书作为教材的教师免费提供（获取方式：请登录华信教育资源网 www. hxedu. com. cn 下载获得）。

本书由冯新宇主持编写并制订大纲。其中第 1、3、8 单元由张鹏南编写，第 2、4、6 单元由陈晓洁编写，第 5、7 单元由冯新宇编写，第 9、10、11 单元由蒋洪波编写，第 12、13 单元及科技英语写作由孙宇博士编写。全书由冯新宇统稿。在编写本书过程中，夏洪洋参与了部分章节绘图及排版工作。

由于水平有限，书中难免有纰漏和欠妥之处，请各位读者不吝赐教。

反馈意见，请发电子邮件至：feng@usth. edu. cn

编　者

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Unit 1

Introduction

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Lesson 2 Moore's Law

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Lesson 1 Semiconductor Materials

In general, all materials may be classified in three major categories - conductors, semiconductors, and insulators - depending upon their ability to conduct an electric current. Semiconductor is a material that has a resistivity value between that of a conductor and an insulator. The conductivity of a semiconductor material can be varied under an external electrical field [1]. As the name indicates. A semiconductor material has poorer conductivity than a conductor, but better conductivity than an insulator.

The study of semiconductor materials began in the early 19th century. Over the years, many semiconductors have been investigated. The Table 1-1 shows a portion of the periodic table related to semiconductors. The elemental semiconductors are those composed of single species of atoms, such as silicon (Si), germanium (Ge), and gray tin (Sn) in column IV and selenium (Se) and tellurium (Te) in column VI. There are, however, numerous compound semiconductors that are composed of two or more elements. Gallium arsenide (GaAs), for example, is a binary III-V compound, which is a combination of gallium (Ga) from column III and arsenic (As) from column V.

Table 1-1 A portion of the periodic table showing elements used in semiconductor materials

Period \ Group	II	III	IV	V	VI
2		B Boron	C Carbon	N Nitrogen	O Oxygen
3		Al Aluminum	Si Silicon	P Phosphorus	S Sulfur
4	Zn Zinc	Ga Gallium	Ge Germanium	As Arsenic	Se Selenium
5	Cd Gadmium	In Indium	Sn Tin	Sb Antimony	Te Tellurium
6	Hg Mercury				

Devices made from semiconductor materials are small but versatile units that can perform an amazing variety of functions in electronic equipments. In addition, semiconductor devices have many important advantages over other types of electron devices. They are very small and light in weight but they consume very little power.

Like other electronic devices, they have the ability to control almost instantly the movement of charges of electricity. They are used as rectifiers, detectors, amplifiers, oscillators, electronic switches, mixers, and modulators.

The materials most often used in semiconductor devices are germanium (Ge) and silicon (Si). Silicon (Si) and germanium (Ge) are widely used as elemental semiconductors. They have a diamond lattice structure. This structure also belongs to the cubic-crystal family.

More than 90% of the earth's crust is composed of Silica (SiO_2) or Silicate, making silicon the second most abundant element on earth. When sand glitters in sunlight, that's silica. Silicon is found in myriad compounds in nature and industry. Most importantly to technology, silicon is the principle platform for semiconductor devices. Silicon is the principal component of most semiconductor devices, especially integrated circuits and microchips. Silicon in the form of a single crystal wafer is the basic building block for the integrated circuit (IC) fabrication.

To keep pace with the growth in IC processing technology, chip size and circuit complexity, silicon crystal and wafers have to be prepared with sustaining increases in diameter and improvements in performation. Silicon used in semiconductor devices manufacturing is currently fabricated into boules that are large enough in diameter to allow the production of 300 mm (12 inch) wafers. Figure1-1 shows a piece of silicon wafer. Ultra large scale integration (ULSI) ICs, fabricated with design rules approaching 60 nm, have to depend on the availability of highly perfect single crystals, which are prepared exclusively from silicon pulled from the melt by the Czochralski (CZ) technique [2].

Silicon is widely used in semiconductors because it remains a semiconductor at higher temperatures than the germanium and because its native oxide is easily grown in a furnace and forms a better semiconductor interface than any other material. Its combination of low raw material cost, relatively simple processing, and a useful temperature range make it currently the best compromise among the various competing materials.

Figure 1-2 shows the first transistor, discovered by Bardeen, Brattain and Shockley at Bell Labs in 1947.

This was perhaps the most important electronics event of the 20th century, as it later made possible the integrated circuit and microprocessor. The triangular hunk is a piece of Ge crystal.

Germanium (Ge) is an important semiconductor material used in transistors and various other electronic devices too. It was a widely used early semiconductor material but its thermal sensitivity makes it less useful than silicon.

Today, germanium is often alloyed with silicon for use in very-high-speed SiGe

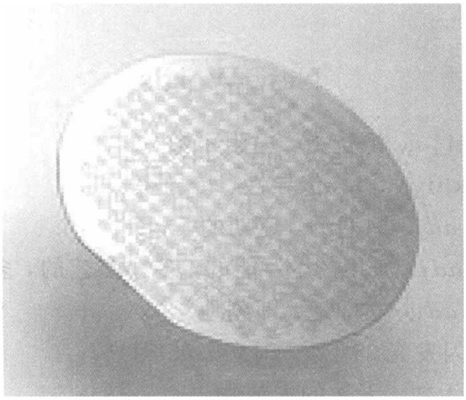

Figure 1-1 A piece of silicon wafer

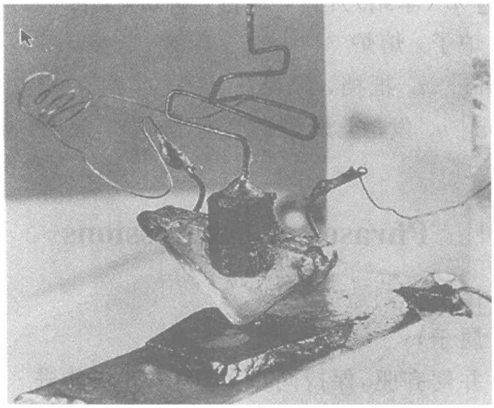

Figure 1-2 The configuration of the first transistor

devices; IBM is a major producer of such devices.

Gallium Arsenide (GaAs) is also widely used in high-speed devices but so far, it has been difficult to form large-diameter boules of this material, limiting the wafer diameter to sizes significantly smaller than silicon wafers thus making most of GaAs devices significantly more expensive than silicon. Other less common materials are also in use or under investigation. Silicon carbide (SiC) has found some application as the raw material for blue light-emitting diodes (LEDs) and is being investigated for use in semiconductor devices that could withstand very high operating temperatures and environments with the presence of significant levels of ionizing radiation. IMPATT diodes have also been fabricated from SiC.

New Words

resistivity [ˌriːzisˈtiviti] *n.* 抵抗力，电阻系数

conductivity [ˌkɔndʌkˈtiviti] *n.* 传导性，传导率

periodic [ˌpiəriˈɔdik] *adj.* 周期的，定期的

versatile [ˈvəːsətail] *adj.* 通用的，万能的，多才多艺的，多面手的

instantly [ˈinstəntli] *adv.* 立即地，即刻地

glitter [gˈlitə] *vi.* 闪闪发光，闪烁，闪光　*n.* 闪光

myriad [ˈmiriəd] *n.* 无数，无数的人或物
adj. 无数的，一万的，种种的

platform [ˈplætfɔːm] *n.* (车站)月台，讲台，讲坛，平台

furnace [ˈfəːnis] *n.* 炉子，熔炉

withstand [wiðˈstænd] *vt.* 抵挡，经受住

radiation [ˌreidiˈeiʃən] *n.* 发散，发光，发热，辐射，放射，放射线，放射物

Phrases & Expressions

made from	由……制造
belong to	属于
keep pace with	并驾齐驱,保持同步,与……齐步前进
a piece of	一块,一片

Technical Terms

ULSI	特大规模集成电路
IC	集成电路
IMPATT diode	碰撞雪崩渡越时间二极管
LED	发光二极管
diamond lattice	晶格
elemental semiconductor	元素半导体
compound semiconductor	化合物半导体
electronic switch	电子开关

Notes

1. Semiconductor is a material that has a resistivity value between that of a conductor and an insulator. The conductivity of a semiconductor material can be varied under an external electrical field.

半导体是一种导电能力介于导体和绝缘体之间的材料，其导电能力在内部电场的作用下是变化的。

2. Ultra large scale integration (ULSI) ICs, fabricated with design rules approaching 60 nm, have to depend on the availability of highly perfect single crystals, which are prepared exclusively from silicon pulled from the melt by the Czochralski (CZ) technique.

现代的特大规模集成电路，其设计工艺已经要求达到 60nm，这都是由于硅单晶具有非常良好的性质，而且这些硅片都是用坩埚直拉法形成的。

Lesson 2 Moore's Law

In April of 1965, Electronics magazine published an article by Intel co-founder Gordon Moore. "Cramming more components onto integrated circuits" Moore's Law summed up the pace of progress in information technology. In the past 40 years, the computer has become an indispensable tool for the majority of people instead of the mystery of the monster[1]. Information technology goes from the laboratory into the countless ordinary families. Internet links to the world, multi-media audio-visual equipment enrich everyone's lives.

Moore's law describes a long-term trend in the history of computing hardware. Since the invention of the integrated circuit in 1958, the number of transistors that can be placed inexpensively on an integrated circuit has increased exponentially, doubling approximately every two years. It has continued for almost half a century and was not expected to stop for at least another decade. Almost every measure of the capabilities of digital electronic devices is strongly linked to Moore's law, such as processing speed, memory capacity, etc[2].

The origins of Moore's Law

The part of Moore's original 1965 paper that's usually cited in support of this formulation is the following Figure 2-1. This graph does indeed show transistor densities doubling every 12 months, so the formulation above is accurate. However, it doesn't quite do justice to the full scope of the picture that Moore painted in his brief, uncannily prescient paper. This is because Moore's paper dealt with more than just shrinking transistor sizes. Moore was ultimately interested in shrinking transistor costs, and in the effects that cheap, ubiquitous computing power would have on the way we live and work. Figure 2-2 shows the origins of Moore's Law.

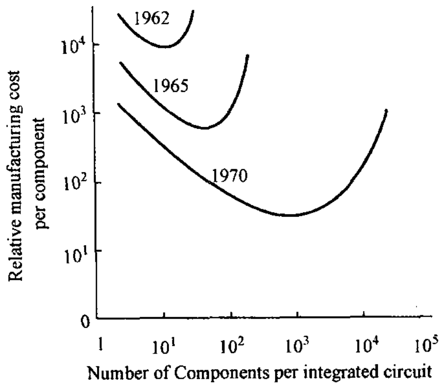

Figure 2-1 Gordon Moore's original graph from 1965

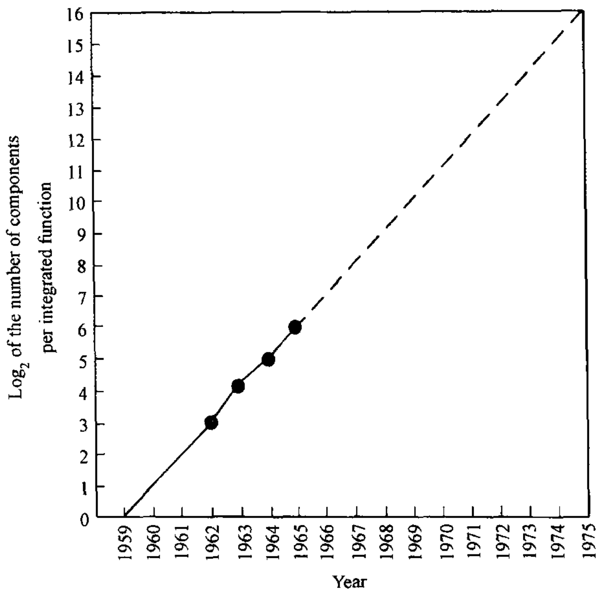

Figure 2-2 The origins of Moore's Law

The effects of Moore's Laws

Several measures of digital technology are improving related to Moore's law, including the size, cost, density and speed of components.

1. Transistors per integrated circuit

The most popular formulation is of the doubling of the number of transistors on integrated circuits every two years. At the end of the 1970s, Moore's law became known as the limit for the number of transistors on the most complex chips.

Figure 2-3 shows transistors per integrated circuit. Recent trends show that this rate has been maintained into 2007.

2. Cost per transistor

As the size of transistors has decreased, the cost per transistor has decreased as well. However, the manufacturing cost per unit area has only increased over time, since materials and energy expenditures per unit area have only increased with each successive technology node.

3. Computing performance per unit cost

As the size of transistors shrinks, the speed at which they operate increases. Moore's law is refer to the rapidly continuing advance in computing performance per unit cost, because increase in transistor count is also a rough measure of computer processing performance.

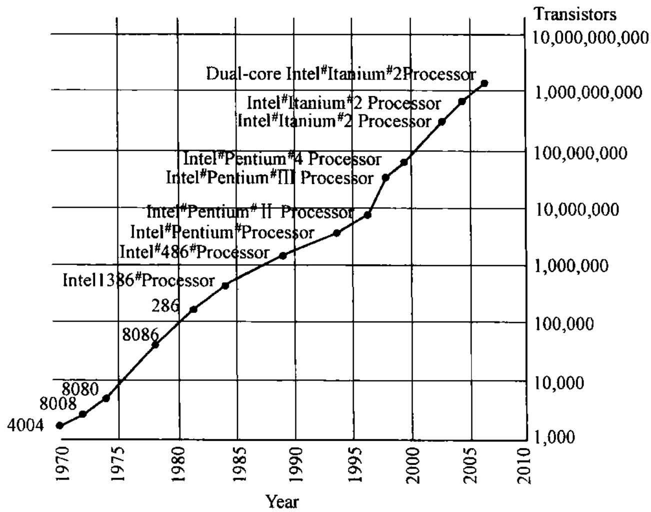

Figure 2-3 Transistors per integrated circuit in 1970s-2010s

4. Power consumption

The power consumption of computer doubles every 18 months.

The future of Moore's Law

Computer industry technology "road maps" predict that Moore's law will continue for several chip generations. Intel has kept that pace for nearly 40 years. Today, they