高等学校电子信息类“十三五”规划教材

信息工程专业英语

主编　黄小莉　夏凌　胡宏平

西安电子科技大学出版社
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内 容 简 介

本书以培养学生的专业英语阅读能力为主要目标，共有 14 个单元，每单元分为基本课文、参考译文和阅读材料三部分，并配有相应的词汇学习和练习等。主要内容包括电路元件、计算机系统基础知识、计算机网络、TCP/IP 协议、数字信号处理概述、数字图像处理、自动语音识别、雷达、小波分析、多媒体技术、互联网、光纤通信、移动通信和一些典型设备的介绍等方面的科技文献，共计 52 篇。

本书可作为高等职业院校及本科信息类专业的教材，也可供信息类专业技术人员学习、参考使用。

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前　　言

我们已经进入了信息化、全球化的时代，贸易往来、信息传递、文化交流、学术沟通等都离不开英语。世界上最先进的科学技术知识，80%以上是用英语记叙、传播的。信息工程领域最先进的技术、理论都是用英语发表、记载的。对于在校学生、教师以及从事电子及信息工程的人员，为了能进一步探索研究，扩展专业知识与专业技能，不假他人之手翻译，获得最真实的第一手资料，学好信息工程专业英语是十分必要的。

本书共有 14 个单元，每单元分为基本课文(Text)、参考译文(Translation)和阅读材料(Reading Materials)三部分，并配有相应的词汇学习和练习。本书旨在逐步提高信息工程类专业学生阅读、理解和翻译信息工程专业资料、书刊、文献的能力。通过学习了解专业英语的词汇、专业术语和写作特点，掌握信息工程类专业英语的基本翻译技巧，为能够以英语为工具，进一步获取、阅读和交流专业技术信息打下扎实的基础。

全书由黄小莉、夏凌、胡宏平主编。第 1、2、3 章由黄小莉编写，第 4、5、6 章由夏凌编写，第 7、8 章由胡宏平编写，第 9、10 章由田果编写，第 11、12 章由罗慰、赵帆编写，第 13 章由翟帆、官伟、龚虹瑞编写，第 14 章由胡庆编写。本书在编写时参考了大量的文献资料，在此向这些文献资料的作者深表谢意。感谢西华大学信息工程特色专业建设项目(2010TSY301)的支持。

由于编者水平有限，书中尚有不足之处，恳切希望读者批评指正。

编　者

2014 年 7 月

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Unit 1 Circuit Components

1.1 Text

Resistors: A resistor is an electrical component that resists the flow of electrical current. The amount of current (I) flowing in a circuit is directly proportional to the voltage across it and inversely proportional to the resistance of the circuit. This is Ohm law and can be expressed as a formula: $I = \frac{U_R}{R}$. The resistor is generally a linear device and its characteristics form a straight line when plotted on a graph.

Resistors are used to limit current flowing to a device, thereby preventing it from burning out, as voltage dividers to reduce voltage for other circuits, as transistor biasing circuits, and to serve as circuit loads.

Generally, resistors (Fig1.1) consist of carbon composition, wire-wound, and metal film. The size of resistors depends on power ratings. Larger sizes are referred to as power resistors. Variable resistors are adjustable: rheostats, potentiometers, and trimmer pots. Precision resistors have a tolerance of 1% or less.

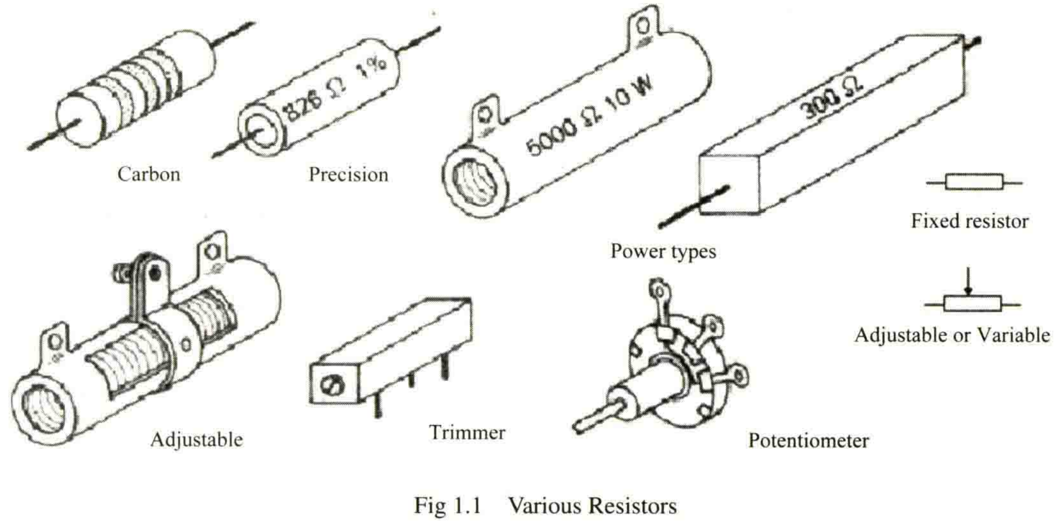

Fig 1.1 Various Resistors

If you are a bit serious about the electronics hobby I recommend learning the "Color Code". It makes a lot easier. The same color code is used for everything else, like coils, capacitors etc. Again, just the color code associated with a number, like: black=0 brown=1 red=2, etc. Fig 1.2 is an example; it is a 4-band resistor.

Can you "create" your own resistors? Of cause and not difficult. Here is how to do it. Draw a line on a piece of paper with a soft pencil, HB or 2HB will do fine. Make the line thick and about 2 inches (5 cm) long. With your multimeter, measure the ohm's value of this line by putting a probe on each side of the line; make sure the probes are touching the carbon from the pencil. The value would probably be around the 800 k to 1.5 M depending line. The resistance will drop considerably, if you erase some of it (length-wise obviously!). You can also use carbon with silicon glue and when it dries measure the resistance, etc.

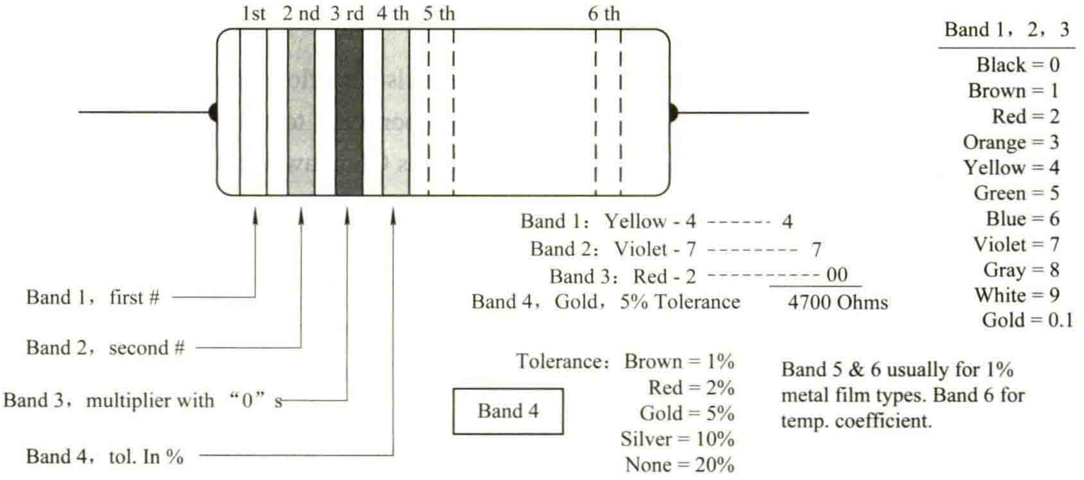

Fig 1.2 An example of resistor color code

Capacitors： A capacitor is an electrical device that can temporarily store electrical energy. Basically, a capacitor consists of two conductors (metal plates) separated by a dielectric insulating material (Fig 1.3(a)), which increases the ability to store a charge.

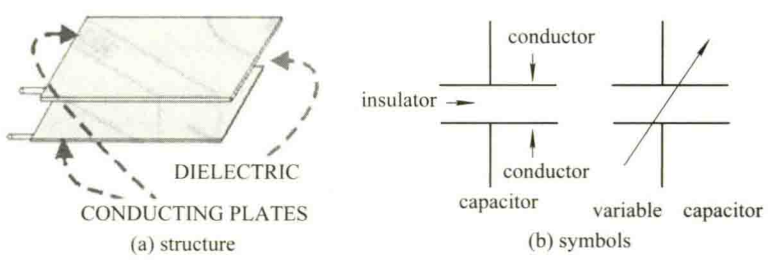

Fig 1.3 Capacitor

The dielectric can be paper, plastic film, mica, ceramic, air or a vacuum. The plates can be aluminum discs, aluminum foil or a thin film of metal applied to opposite sides of a solid dielectric. The conductor- dielectric-conductor sandwich can be rolled into a cylinder or left flat, the symbols of capacitor are shown in Fig 1.3(b).

A capacitor will block DC current, but appears to pass AC current by charging and discharging. It develops an AC resistance, known as capacitive reactance, which is affected by the capacitance and AC frequency. The formula for capacitive reactance is $X_C = 1/\ (2\pi f_C)$, with units of ohms.

Inductors: An inductor is an electrical device, which can temporarily store electromagnetic energy in the field about it as long as current is flowing through it. The inductor is a coil of wire that may have an air core or an iron core to increase its inductance. A powered iron core in the shape of a cylinder may be adjusted in and out of the core.

An inductor tends to oppose a change in electrical current, it has no resistance to DC current but has an AC resistance to AC current, known as inductive reactance, this inductive reactance is affected by inductance and the AC frequency and is given by the formula $X_L = 2\pi f_L$, with units of ohms. Inductors are used for filtering AC current, increasing the output of the RF (Radio Frequency) amplifier.

Inductors are available in variety of shapes (Fig 1.4): air core, iron core (which may look like a transformer, but has only two leads), toroidal (doughnut shaped), small tubular with epoxy, RF choke with separate coils on a cylinder, and tunable RF coil with a screwdriver adjustment.

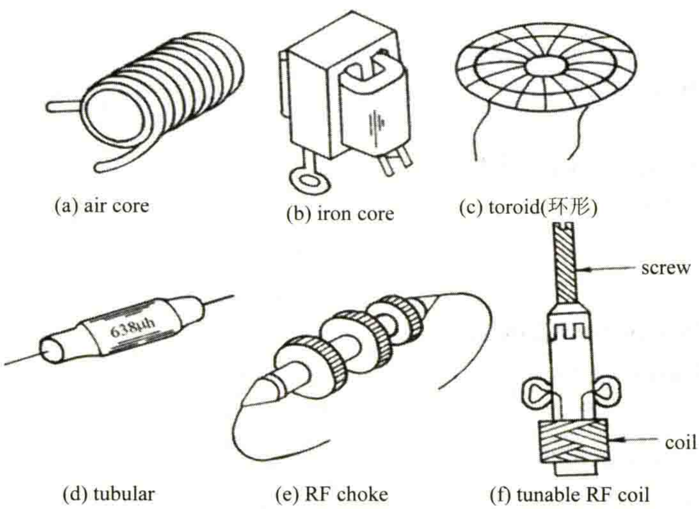

Fig 1.4 Various inductors

Technical Words and Phrases

reactance	n. 电抗
resistance	n.【电】电阻值，中文有时简称电阻
resistor	n.【电】电阻器，中文有时简称电阻
voltage	n.【电工】电压，伏特数；电压(电位差)
capacitance	n. 电容量
capacitor	n. 电容器
charge	n. 负荷，电荷，充电 v. 装满，充电
dielectric	n. 电介质，绝缘体 adj. 非传导性的
electrical	adj. 电的，有关电的
formula	n. 公式，规则，客套话
inductance	n. 电感量，电感值

inductor n. 诱导物，感应器，电感器
insulating adj. 绝缘的
multimeter n. 万用表 vt. 多点测量
probe n. 探针，外太空探测器；探测飞船，探索
be inversely proportional to 与……成反比
be affected by … 受……影响
be available 是可利用的，可用的
be directly proportional to 与……成正比
be expressed as a formula 用公式表示成……
be proportional to 与……成比例
be used to … 被用于……
in various shapes and sizes 各种形状和尺寸
to serve as … 用作……

1.1.1 Exercises

1. Put the Phrases into English

(1) 运算放大器；
(2) 传递函数；
(3) 电子器件；
(4) 集成电路；
(5) 反馈电路；
(6) 性能参数。

2. Put the Phrases into Chinese

(1) electrical components;
(2) Ohm law;
(3) limit current;
(4) voltage divider;
(5) transistor biasing circuits.

3. Translation

(1) Resistors are used to limit current flowing to a device, thereby preventing it from burning out, as voltage dividers to reduce voltage for other circuits, as transistor biasing circuits, and to serve as circuit loads.

(2) If you are a bit serious about the electronics hobby I recommend learning the "Color Code".

(3) A capacitor will block DC current, but appears to pass AC current by charging and discharging.

(4) Capacitors are available in various shapes and sizes.

(5) Capacitors are used for filtering, by passing signals, for timing circuits, and for radio-frequency (RF) tuning circuits.

(6) An inductor is an electrical device, which can temporarily store electromagnetic energy in the field about it as long as current is flowing through it.

(7) The inductive reactance is affected by inductance and the ac frequency.

(8) The input voltage is to the primary winding and the induced voltage is taken off the

secondary winding.

1.1.2 参考译文

电阻器：电阻器是一种能阻碍电流流动的电子器件。电阻器中流过的电流与加在电阻两端的电压成正比，与电阻的阻值成反比。这就是欧姆定律，可以用公式表示成 $I = U_R/R$。电阻器通常是线性器件，它的(伏安)特性曲线是一条直线。

电阻器常用作限流器，以限制流过器件的电流，以防止器件因流过的电流过大而烧坏。电阻器也可以用作分压器，以减小其他电路的电压，如晶体管偏置电路。电阻器还可用作电路的负载。

一般来说，电阻有碳(膜)电阻、线绕电阻和金属膜电阻(如图 1.1 所示)，电阻器尺寸的大小与电阻的(额定)功率有关，尺寸比较大的电阻器通常是高功率电阻器。可变电阻器是电阻值可调节的电阻器，如变阻器、电位器和微调电位器。精密电阻器是指其误差率在 1%或更小的电阻器。

如果你对电子技术颇有兴趣，建议学会电阻的"彩色条形码"识别方法，这样会带来很多方便。而且这种彩色条形码标注方法在其他器件上也适用，如线圈(电感)、电容等。这种方法是用彩色表示数字，如黑色=0，棕色=1，红色=2 等，图 1.2 是个彩色条形码电阻的例子。

自己可以制作一个电阻(器)吗？当然可以，而且也不难。这里教你如何做一个电阻(器)，用一支软铅笔(HB 铅笔或用 2HB 铅笔更好)，在纸上画一段大约 2 英寸(5 cm)长的粗线。用万用表测量这段线的欧姆值，(方法是)把万用表的两个探笔分别与铅笔线的两端相接触，一定要让探笔与线端的碳接触。根据线的粗细，电阻值大约为 800 kΩ～1.5 MΩ。如果你擦掉一些线，使线明显变短，电阻值就会变小。你也可以用掺有硅胶的碳粉来制作电阻器，当硅胶干了以后测量其电阻值等。

电容器：电容器是可以暂时存储电能的电子器件。电容器一般由两块导体(金属极板)组成(见图 1.3(a))，中间用一层不导电的绝缘材料隔开，这层绝缘材料可以增加电容存储电荷的本领(即增大电容量)。

绝缘材料可以是纸、塑料片、云母、陶瓷材料、空气或真空。极板可以是薄铝板、铝箔或在一片两面各贴上一层金属薄膜的绝缘板。可以直接把一个这种导体-绝缘体-导体(三明治式)制成平板电容器，也可以把它卷起来成为圆柱形电容器。电容器的符号如图 1.3(b)所示。

电容器隔直流电，但能以充电和放电的方式通过交流电。它构成的交流电阻抗称为容抗。容抗与电容量和交流电的频率有关，容抗的公式为 $X_C = 1/(2\pi f_C)$，其单位为欧姆。

电感器：当电流流过电感器时，电感器周围就有电磁场，电感器是以电磁场的形式暂时存储电磁能量的电子器件。电感器是一组线圈，有的电感器线圈中有可增加其电感量的铁芯，可调电感有一个强磁的圆柱状铁芯，通过调节铁芯可以增加或减少电感量。

电感量有阻碍电流变化的趋势，对直流电而言，电感器是没有阻碍作用的，但对交流电来说，电感器有一个交流阻抗，称为感抗。这个感抗与电感量和交流电的频率有关，可以用公式表示为 $X_L = 2\pi f_L$，其单位为欧姆。电感器可以用来滤波、增加 RF(无线电频率)放

大器的输出。电感器有各式各样的形状(如图 1.4 所示)，空芯的、铁芯的(铁芯的有时看起来像个变压器，但只有两个端口)、环状的(圆环形的)、管状的(以环氧树脂为材料)，RF 扼流圈是由圆柱上分开的线圈构成，而且可调的线圈带有一把调整螺丝刀。

1.2 Reading Materials

1.2.1 How Semiconductors Work

Semiconductors have had a monumental impact on our society. You find semiconductors at the heart of microprocessor chips as well as transistors. Anything that's computerized or uses radio waves depends on semiconductors.

Today, most semiconductor chips and transistors are created with silicon. You may have heard expressions like "Silicon Valley" and the "silicon economy," and that's why — silicon is the heart of any electronic device.

A diode is the simplest possible semiconductor device, and is therefore an excellent beginning point if you want to understand how semiconductors work. In this article, you'll learn what a semiconductor is, how doping works and how a diode can be created using semiconductors. But first, let's take a close look at silicon.

Silicon is a very common element — for example, it is the main element in sand and quartz. If you look "silicon" up in the periodic table(Fig 1.5), you will find that it sits next to aluminum, below carbon and above germanium.

Fig 1.5 Silicon sits next to aluminum and below carbon in the periodic table

Carbon, silicon and germanium (germanium, like silicon, is also a semiconductor) have a unique property in their electron structure — each has four electrons in its outer orbital. This allows them to form nice crystals. The four electrons form perfect covalent bonds with four neighboring atoms, creating a lattice. In carbon, we know the crystalline form as diamond. In silicon, the crystalline form is a silvery, metallic-looking substance.

In a silicon lattice(Fig 1.6), all silicon atoms bond perfectly to four neighbors, leaving no free electrons to conduct electric current. This makes a silicon crystal an insulator rather than a conductor.

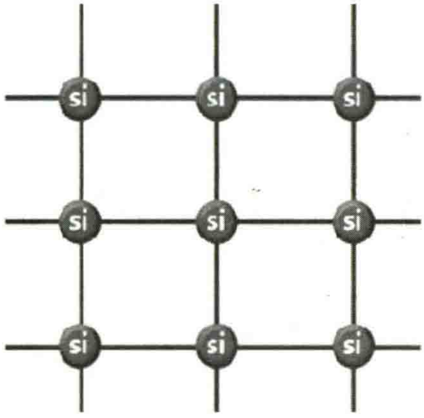

Fig 1.6 Silicon lattice

Metals tend to be good conductors of electricity because they usually have "free electrons" that can move easily between atoms, and electricity involves the flow of electrons. While silicon crystals look metallic, they are not, in fact, metals. All of the outer electrons in a silicon crystal are involved in perfect covalent bonds, so they can't move around. A pure silicon crystal is nearly an insulator — very little electricity will flow through it.

But you can change all this through a process called doping. You can change the behavior of silicon and turn it into a conductor by doping it. In doping, you mix a small amount of an impurity into the silicon crystal.

There are two types of impurities:

N-type - In N-type doping, phosphorus or arsenic is added to the silicon in small quantities. Phosphorus and arsenic each have five outer electrons, so they're out of place when they get into the silicon lattice. The fifth electron has nothing to bond to, so it's free to move around. It takes only a very small quantity of the impurity to create enough free electrons to allow an electric current to flow through the silicon. N-type silicon is a good conductor. Electrons have a negative charge, hence the name N-type.

P-type- In P-type doping, boron or gallium is the dopant. Boron and gallium each have only three outer electrons. When mixed into the silicon lattice, they form "holes" in the lattice where a silicon electron has nothing to bond to. The absence of an electron creates the effect of a positive charge, hence the name P-type. Holes can conduct current. A hole happily accepts an electron from a neighbor, moving the hole over a space. P-type silicon is a good conductor.

A minute amount of either N-type or P-type doping turns a silicon crystal from a good insulator into a viable (but not great) conductor — hence the name "semiconductor".

N-type and P-type silicon are not that amazing by themselves; but when you put them together, you get some very interesting behavior at the junction. That's what happens in a diode.

A diode(Fig 1.7) is the simplest possible semiconductor device. A diode allows current to flow in one direction but not the other. You may have seen turnstiles at a stadium or a subway station that let people go through in only one direction. A diode is a one-way turnstile for electrons.

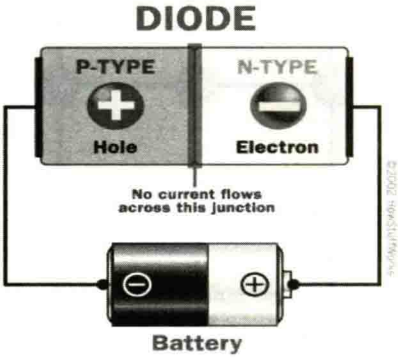

Fig 1.7 Diode

When you put N-TYPE and P-TYPE silicon together as shown in this diagram, you get a very interesting phenomenon that gives a diode its unique properties.

Even though N-TYPE silicon by itself is a conductor, and P-TYPE silicon by itself is also a conductor, the combination shown in the diagram does not conduct any electricity. The negative electrons in the N-type silicon get attracted to the positive terminal of the battery.

The positive holes in the P-TYPE silicon get attracted to the negative terminal of the battery. No current flows across the junction because the holes and the electrons are each moving in the wrong direction. If you flip the battery around, the diode conducts electricity just fine. The free electrons in the N-TYPE silicon are repelled by the negative terminal of the battery. The holes in the P-TYPE silicon are repelled by the positive terminal. At the junction between the N-TYPE and P-TYPE silicon, holes and free electrons meet. The electrons fill the holes. Those holes and free electrons cease to exist, and new holes and electrons spring up to take their place. The effect is that current flows through the junction.

1.2.2 The Power Supply

A power supply is a device that takes an incoming electrical current and amplifies it to levels required by various devices. In many instances, a power supply is also implemented to take the incoming electricity and deliver it across many other electronic devices, often at different preset levels. This device allows manufacturers to create electronics and machinery that can handle many different tasks from a single source of power, without the need for various adapters and additional hardware. Within other devices, a power supply is used to transform various types of power into a compatible format to be stored, like solar energy to electrical energy.

Perhaps the most common use of a power supply is within computer systems. As electricity enters the power supply, it is momentarily stored and then distributed to numerous functions throughout the system, allowing the motherboard, hard drive, and other various devices to receive electricity in order to function. Each one of these items requires a separate voltage (amperes), and it is delivered through specialized connectors that attach in a certain manner. For example, motherboards require either a 20-pin power supply or a 24-pin power supply, and they are not interchangeable without the purchase of an additional adapter.

Modern vehicles also require a type of power supply in order to function, and it is referred to as an alternator(Fig 1.8). Although the wiring and design may be different, it essentially works in the exact same manner by taking incoming power and delivering it throughout the vehicle at the necessary levels. Alternators can be found on everything from lawn mowers to sea craft and industrial equipment, and without them, the devices would be rendered useless.

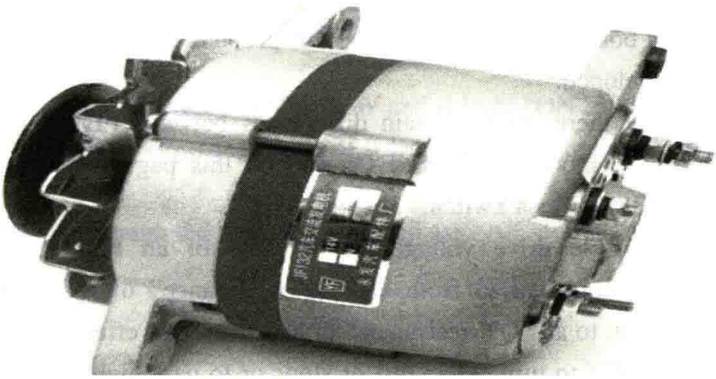

Fig 1.8 Alternator for modern vehicles

Another common type of power supply can be found on windmills and solar panels(Fig 1.9), and its primary function is to convert various types of energy into electricity so that it can be stored and distributed across a grid. This type of power supply is referred to as a generator, and it is often a free-standing object that is installed between the power source and the storage unit. Home and commercial generators, used during power outages, also work off of this same premise by transforming petroleum products into electrical energy by means of an engine. Many types of industrial tools also implement a type of generator. Other common types of power supplies are used within circuit breakers, battery-powered items and transformers.

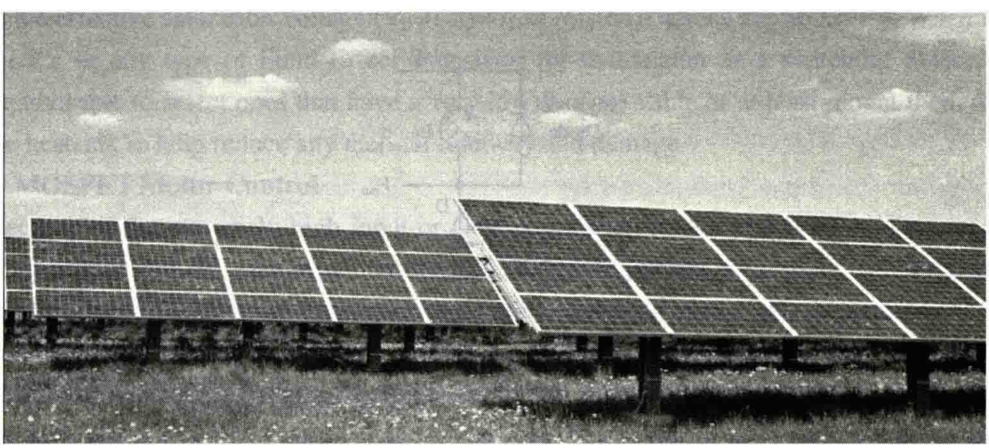

Fig 1.9 Solar panels

1.2.3 MOSFET Switches

The N-channel, Enhancement-mode MOSFET operates using a positive input voltage and has an extremely high input resistance (almost infinite) making it possible to interface with nearly any logic gate or driver capable of producing a positive output. Also, due to this very high input (Gate) resistance we can parallel together many different MOSFET's until we achieve the current handling limit required. While connecting together various MOSFET's may enable us to switch high current or high voltage loads, doing so becomes expensive and impractical in both components and circuit board space. To overcome this problem Power Field Effect Transistors or Power FET's where developed.

We now know that there are two main differences between FET's, Depletion-mode for JFET's and Enhancement-mode for MOSFET's and on this page we will look at using the Enhancement-mode MOSFET as a Switch.

By applying a suitable drive voltage to the Gate of an FET the resistance of the Drain-Source channel can be varied from an "OFF-resistance" of many hundreds of kΩ's, effectively an open circuit, to an "ON-resistance" of less than 1 Ω, effectively a short circuit. We can also drive the MOSFET to turn "ON" fast or slow, or to pass high currents or low currents. This ability to turn the power MOSFET "ON" and "OFF" allows the device to be used as a very efficient switch with switching speeds much faster than standard bipolar junction transistors.

An example of using the MOSFET as a switch:

In this circuit(Fig 1.10) arrangement an Enhancement-mode N-channel MOSFET is being used to switch a simple lamp "ON" and "OFF" (could also be an LED). The gate input voltage V_{GS} is taken to an appropriate positive voltage level to turn the device and the lamp either fully "ON", (V_{GS} =+ve) or a zero voltage level to turn the device fully "OFF"(V_{GS} = 0). If the resistive load of the lamp was to be replaced by an inductive load such as a coil or solenoid, a "Flywheel" diode would be required in parallel with the load to protect the MOSFET from any back-emf.

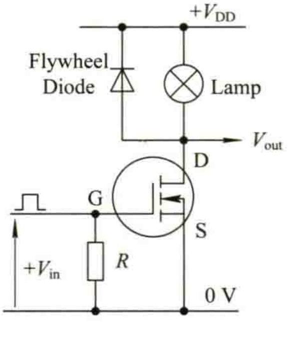

Fig 1.10 Circuit with an Enhancement-mode N-channel MOSFET

Above shows a very simple circuit for switching a resistive load such as a lamp or LED. But when using power MOSFET's to switch either inductive or capacitive loads some form of