

Physics Of Semiconductor Devices

Sze Solution

Metal-semiconductor junction

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In solid-state physics, a metal-semiconductor (M-S) junction is a type of electrical junction in which a metal comes in close contact with a semiconductor material. It is the oldest type of practical semiconductor device. M-S junctions can either be rectifying or non-rectifying. The rectifying metal-semiconductor junction forms a Schottky barrier, making a device known as a Schottky diode, while the non-rectifying junction is called an ohmic contact. (In contrast, a rectifying semiconductor-semiconductor junction, the most common semiconductor device today, is known as a p-n junction.)

Metal-semiconductor junctions are crucial to the operation of all semiconductor devices. Usually, an ohmic contact is desired so that electrical charge can be conducted easily between the active region of...

Doping (semiconductor)

In semiconductor production, doping is the intentional introduction of impurities into an intrinsic (undoped) semiconductor for the purpose of modulating

In semiconductor production, doping is the intentional introduction of impurities into an intrinsic (undoped) semiconductor for the purpose of modulating its electrical, optical and structural properties. The doped material is referred to as an extrinsic semiconductor.

Small numbers of dopant atoms can change the ability of a semiconductor to conduct electricity. When on the order of one dopant atom is added per 100 million intrinsic atoms, the doping is said to be low or light. When many more dopant atoms are added, on the order of one per ten thousand atoms, the doping is referred to as high or heavy. This is often shown as n+ for n-type doping or p+ for p-type doping. (See the article on semiconductors for a more detailed description of the doping mechanism.) A semiconductor doped to such...

Ohmic contact

on the lifetime of electronic devices. "Barrier Height Correlations and Systematics". Sze, S.M. (1981). Physics of Semiconductor Devices. John Wiley & Sons

An ohmic contact is a non-rectifying electrical junction: a junction between two conductors that has a linear current-voltage (I-V) curve as with Ohm's law. Low-resistance ohmic contacts are used to allow charge to flow easily in both directions between the two conductors, without blocking due to rectification or excess power dissipation due to voltage thresholds.

By contrast, a junction or contact that does not demonstrate a linear I-V curve is called non-ohmic. Non-ohmic contacts come in a number of forms, such as p-n junction, Schottky barrier, rectifying heterojunction, or breakdown junction.

Generally the term "ohmic contact" implicitly refers to an ohmic contact of a metal

to a semiconductor, where achieving ohmic contact resistance is possible but requires careful technique. Metal-metal...

Oxide thin-film transistor

ISSN 1468-6996. PMC 5090337. PMID 27877346. Sze, S.M.; Ng, Kwok K. (2006-04-10). *Physics of Semiconductor Devices*. doi:10.1002/0470068329. ISBN 9780470068328

An oxide thin-film transistor (oxide TFT) or metal oxide thin film transistor is a type of thin film transistor where the semiconductor is a metal oxide compound. An oxide TFT is distinct from a metal oxide field effect transistor (MOSFET) where the word "oxide" refers to the insulating gate dielectric (normally silicon dioxide). In an oxide TFT, the word oxide refers to the semiconductor. Oxide TFTs have applications as amplifiers to deliver current to emitters in display backplanes.

Thin-film transistor

Sze, S.M.; Ng, Kwok K. (2006-04-10). *Physics of Semiconductor Devices*. doi:10.1002/0470068329. ISBN 9780470068328. Powell, M.J. (1989). "The physics of

A thin-film transistor (TFT) is a special type of field-effect transistor (FET) where the transistor is made by thin film deposition. TFTs are grown on a supporting (but non-conducting) substrate, such as glass. This differs from the conventional bulk metal-oxide-semiconductor field-effect transistor (MOSFET), where the semiconductor material typically is the substrate, such as a silicon wafer. The traditional application of TFTs is in TFT liquid-crystal displays.

Microfabrication

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Microfabrication is the process of fabricating miniature structures of micrometre scales and smaller. Historically, the earliest microfabrication processes were used for integrated circuit fabrication, also known as "semiconductor manufacturing" or "semiconductor device fabrication". In the last two decades, microelectromechanical systems (MEMS), microsystems (European usage), micromachines (Japanese terminology) and their subfields have re-used, adapted or extended microfabrication methods. These subfields include microfluidics/lab-on-a-chip, optical MEMS (also called MOEMS), RF MEMS, PowerMEMS, BioMEMS and their extension into nanoscale (for example NEMS, for nano electro mechanical systems). The production of flat-panel displays and solar cells also uses similar techniques.

Miniaturization...

List of semiconductor scale examples

Collins English Dictionary. Retrieved 2019-03-02. Sze, Simon M. (2002). *Semiconductor Devices: Physics and Technology (PDF) (2nd ed.)*. Wiley. p. 4. ISBN 0-471-33372-7

Listed are many semiconductor scale examples for various metal-oxide-semiconductor field-effect transistor (MOSFET, or MOS transistor) semiconductor manufacturing process nodes.

Field-effect transistor

Materials, Devices, Applications, 2 Volumes. John Wiley & Sons. p. 14. ISBN 978-3-527-34053-8. Grundmann, Marius (2010). The Physics of Semiconductors. Springer-Verlag

The field-effect transistor (FET) is a type of transistor that uses an electric field to control the current through a semiconductor. It comes in two types: junction FET (JFET) and metal-oxide-semiconductor FET (MOSFET). FETs have three terminals: source, gate, and drain. FETs control the current by the application of a voltage to the gate, which in turn alters the conductivity between the drain and source.

FETs are also known as unipolar transistors since they involve single-carrier-type operation. That is, FETs use either electrons (n-channel) or holes (p-channel) as charge carriers in their operation, but not both. Many different types of field effect transistors exist. Field effect transistors generally display very high input impedance at low frequencies. The most widely used field-effect...

Diode

the Wayback Machine. (PDF). Retrieved 2013-12-19. Sze, S. M. (1998) Modern Semiconductor Device Physics, Wiley Interscience, ISBN 0-471-15237-4 Protecting

A diode is a two-terminal electronic component that conducts electric current primarily in one direction (asymmetric conductance). It has low (ideally zero) resistance in one direction and high (ideally infinite) resistance in the other.

A semiconductor diode, the most commonly used type today, is a crystalline piece of semiconductor material with a p-n junction connected to two electrical terminals. It has an exponential current-voltage characteristic. Semiconductor diodes were the first semiconductor electronic devices. The discovery of asymmetric electrical conduction across the contact between a crystalline mineral and a metal was made by German physicist Ferdinand Braun in 1874. Today, most diodes are made of silicon, but other semiconducting materials such as gallium arsenide and germanium...

Transistor

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A transistor is a semiconductor device used to amplify or switch electrical signals and power. It is one of the basic building blocks of modern electronics. It is composed of semiconductor material, usually with at least three terminals for connection to an electronic circuit. A voltage or current applied to one pair of the transistor's terminals controls the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal. Some transistors are packaged individually, but many more in miniature form are found embedded in integrated circuits. Because transistors are the key active components in practically all modern electronics, many people consider them one of the 20th century's greatest inventions...

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