

# Power Semiconductor Devices Baliga

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... 798f309569 The fabrication process is performed in highly specialized semiconductor fabrication... 798f309569 The silicon-based RF LDMOS (radio-frequency LDMOS) is the most widely used RF power amplifier in mobile networks, enabling the majority of the world's cellular voice and... 798f309569 The design of power MOSFETs was made possible by the evolution of MOSFET and CMOS technology, used for manufacturing integrated circuits since the 1960s. The power MOSFET shares its operating principle with its low-power counterpart, the lateral MOSFET. The power... 798f309569 Power semiconductors are found in systems delivering as little as a few tens of milliwatts for a headphone amplifier, up to around a gigawatt in a high-voltage direct current transmission line. 798f309569

Insulated-gate bipolar transistor It was developed to combine high efficiency with fast switching. insulated-gate bipolar transistor (IGBT) is a three-terminal power semiconductor device primarily forming an electronic switch. It was developed to combine An insulated-gate bipolar transistor (IGBT) is a three-terminal power semiconductor device primarily forming an electronic switch. It consists of four alternating layers (NPNP) that are controlled by a metal–oxide–semiconductor (MOS) gate structure 798f309569

Although the structure of the IGBT is topologically similar to a thyristor with a "MOS" gate (MOS-gate thyristor), the thyristor action is completely suppressed, and only the transistor action is permitted in the entire device operation range. It is used in switching power supplies in high-power applications: variable-frequency drives (VFDs) for motor control in electric cars, trains, variable-speed refrigerators, and air conditioners, as well as lamp ballasts, arc-welding machines... 798f309569

B. Jayant Baliga Bantval Jayant Baliga (born (1948-04-28)28 April 1948) is an Indian electrical engineer best known for his work in power semiconductor devices, and particularly Bantval Jayant Baliga (born (1948-04-28)28 April 1948) is an Indian electrical engineer best known for his work in power semiconductor devices, and particularly the invention of the insulated gate bipolar transistor (IGBT) 798f309569

LDMOS 35, pp. synchrotrons FET amplifier Power semiconductor device RF CMOS A. 1079-1081, 2014 Baliga, Bantval Jayant LDMOS (laterally-diffused metal-oxide semiconductor) is a planar double-diffused MOSFET (metal–oxide–semiconductor field-effect transistor) used in amplifiers, including microwave power amplifiers, RF power amplifiers and audio power amplifiers. Lett. As an example, the drift region of this power MOSFET is fabricated using up to three ion implantation sequences in order to achieve the appropriate doping profile needed to withstand high electric fields. The fabrication of LDMOS devices mostly involves various ion-implantation and subsequent annealing cycles. These transistors are often fabricated on p/p+ silicon epitaxial layers. Elhami Khorasani, IEEE Electron Dev. , vol 798f309569

During operation in blocking mode, the highest electric field occurs at the N+/p+ junction. The presence of a sharp corner at the bottom of the groove enhances the electric field at the edge of the channel in the depletion region, thus reducing the breakdown voltage of the device. This electric field launches electrons into... 798f309569 The "V" shape of the MOSFET's gate allows the device to deliver a higher amount of current from the source to the drain of the device. The shape of the depletion region creates a wider channel, allowing more current to flow through it. 798f309569

Semiconductor device fabrication Silicon is almost always used, but various compound semiconductors are used for specialized applications. It is a multiple-step photolithographic and physico-chemical process (with steps such as thermal oxidation, thin-film deposition, ion-implantation, etching) during which electronic circuits are gradually created on a wafer, typically made of pure single-crystal semiconducting material. Semiconductor device fabrication is the process used to manufacture semiconductor devices, typically integrated circuits (ICs) such as microprocessors Semiconductor device fabrication is the process used to manufacture semiconductor devices, typically integrated circuits (ICs) such as microprocessors, microcontrollers, and memories (such as RAM and flash memory). Steps such as etching and photolithography can be used to manufacture other devices such as LCD and OLED displays 798f309569

MOSFET ISBN 978-0-534-94098-0. Power Semiconductor Devices. "Power MOSFET Basics: Understanding In electronics, the metal–oxide–semiconductor field-effect transistor (MOSFET, MOS-FET, MOS FET, or MOS transistor) is a type of field-effect transistor (FET), most commonly fabricated by the controlled oxidation of silicon. This ability to change conductivity with the amount of applied voltage can be used for amplifying or switching electronic signals. Another near-synonym is insulated-gate field-effect transistor (IGFET). It has an insulated gate, the voltage of which determines the conductivity of the device. Boston: PWS publishing Company. Jayant (1996). 1039/C3TC30134F. The term metal–insulator–semiconductor field-effect transistor (MISFET) is almost synonymous with MOSFET. Baliga, B 798f309569

RF power amplifier Design goals often include gain, power output, bandwidth, power efficiency, linearity (low signal compression at rated output), input and output impedance matching, and heat dissipation. form of a radar). RF power amplifiers using LDMOS (laterally diffused MOSFET) are the most widely used power semiconductor devices in wireless telecommunication A radio-frequency power amplifier (RF power amplifier) is a type of electronic amplifier that converts a

low-power radio-frequency (RF) signal into a higher-power signal. Typically, RF power amplifiers are used in the final stage of a radio transmitter, their output driving the antenna 798f309569

In 1993, Baliga was elected as a member into the National Academy of Engineering for contributions to power semiconductor devices leading to the advent of smart power technology, and in 2024, won the Finnish Millennium Technology Prize for his invention of the IGBT. 798f309569 A power semiconductor device is usually used in "commutation mode" (i.e., it is either on or off), and therefore has a design optimized for such usage; it should usually not be used in linear operation. Linear power circuits are widespread as voltage regulators, audio amplifiers, and radio frequency amplifiers. 798f309569

Power semiconductor device Such a device is also called a power device or, when used in an integrated circuit, a power IC. A power semiconductor device is a semiconductor device used as a switch or rectifier in power electronics (for example in a switched-mode power supply) A power semiconductor device is a semiconductor device used as a switch or rectifier in power electronics (for example in a switched-mode power supply) 798f309569

Doping (semiconductor) Wiley. E 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. 32. ISBN 978-0-471-81986-8. Schmidt, P. Baliga, B. Retrieved 2022-12-22. Modern Power Devices. edu. "Spin-on Glass" p. The doped material is referred to as an extrinsic semiconductor. mines. inside. Jayant (1987) 798f309569

The main advantage of a MOSFET is that it requires almost no input current to control the load current under steady-state or low-frequency conditions, especially compared to bipolar... 798f309569

Power MOSFET It shares with the IGBT an isolated gate that makes it easy to drive. designed to handle significant power levels. They can be subject to low gain, sometimes to a degree that the gate voltage needs to be higher than the voltage under control. Compared to the other power semiconductor devices, such as an insulated-gate bipolar transistor (IGBT) or a thyristor, its main advantages are high switching speed and good efficiency at low voltages. Compared to the other power semiconductor devices, such as an insulated-gate bipolar transistor (IGBT) or a thyristor A power MOSFET is a specific type of metal–oxide–semiconductor field-effect transistor (MOSFET) designed to handle significant power levels 798f309569

VMOS Jayant (2008), "Power MOSFETs", Fundamentals of Power Semiconductor Devices, Springer US, pp. VMOS is also used to describe the V-groove shape vertically cut into the substrate material. 1016/0038-1101(74)90026-4. doi:10. 276–503, doi:10 A VMOS () (vertical metal oxide semiconductor or V-groove MOS) transistor is a type of metal–oxide–semiconductor field-effect transistor (MOSFET). Baliga, B 798f309569

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