

A Briefly Survey in Electronics System Design

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Abstract

In this paper, it will be tried to briefly talk about electronic system design. In these 20 years, electronic system such as other sciences has improved. From analog and digital circuits toward nano bio systems. It will be discussed the main methods of electronic system design not only in analog and digital systems but also about nano and bio electronics systems.

Keywords: CMOS, Integrated Circuits, FinFET, GAA.FET, MOSFET

1. Material and Methods

1.1 Analog Electronic System

Analog circuits are circuits whose inputs and outputs are continuously varying analog signals in which the information is conveyed by the instantaneous value of the waveform. If we learn how to design and analysis discrete circuits transistors amplifier, it means we have learnt how to design by MOSFET and BJT in basic circuits. Circuits and systems that are to be produced in high volume (that is, millions of units) can be produced much more economically and reliably using integrated circuits (IC) technology. Integrated. Circuit's fabrication technology impose constraints on and provides opportunities to the circuit designer. To cope with the constraints and take advantage of the opportunity, IC designers have over the years invented (and continue to invent) many ingenious techniques, and a distinct philosophy has emerged for the design of integrated circuits.

1.2 Digital Electronic System

CMOS digital circuits utilize NMOS and PMOS transistors as switches. We know that a MOS transistor can operate as an on/off switch by using the gate voltage to operate the transistor in the triode region ("on" position) or in the cutoff region ("off" position). It is observed that the gate terminal of the MOSFET is used as the controlling node, and thus it is usually one of the input terminals of the logic gate. A CMOS logic circuit is I effect an extension, or a generalization, of the CMOS inverter: The inverter consists of an NMOS pull. Down transistor and a PMOS pull. Up transistor, operated by the input voltage in a complementary fashion. The CMOS logic gate consists of two networks: The pull. Down network (PDN) constructed of NMOS transistors, and the pull. Up network (PUN) constructed of PMOS transistors.

1.3 Nano and Bio. Electronic System

One of the main priorities in the field of electronics is the miniaturization of components of electronic equipment. This allows for the development of fully integrated integrated circuits. This can pave the way for the development of fully integrated integrated circuits and faster processors. The inherent limitations of silicon-based electronic devices have prevented them from being scaled up to nanometer dimensions. To keep Moore's Law in place, it is the use of nanoparticles and either single molecules or molecular layers in the electrical industry. That has led to the emergence of the fledgling branch of molecular electronics.

1.4 Micro Electronics Circuits

Microelectronics refers to the integrated. Circuits (IC) technology that at the time of this writing is capable of producing circuits that contain billions of components in a small piece of silicon (known as silicon chip) whose area roughly 100 mm^2 . One such microelectronics circuit is a complete digital computer, which is known, appropriately, as a microcomputer or, more generally, a microprocessor. Indeed, it is difficult to conceive of modern life without microelectronics circuits.

• **Integrated Circuits are 3 Kinds:** Analog integrated circuits and Digital integrated circuits. And nowadays Nano.Electronics system circuits.

Analog integrated circuits include blocks of integrated.circuit Amplifiers, filters and oscillators.

Digital integrated circuits include CMOS digital circuits, memory and clocking circuits.

Different materials are used in electronic applications: (Silicon,

Silicon Carbide (SiC), Gallium Arsenide (GaAs) and Indium Phosphide (InP).

The steps to create wafers are Wafer Creation, Wafer Refining, Crystallography, Create Silicon Dioxide (Thermal Oxidation, Doping, Epitaxy, Deposition, Diffusion, Implantation, Annealing, lithography, Etching and Packaging).

CMOS Process and FinFET Devices Models are used in these decades.

The CMOS Process is a very cheap process because many tricks have been found to reduce the cost that mainly depends on masks and photolithography. This process is also called twin tub since it is possible to create two independent wells (p and n type) independently on the starting type of substrate.

• **FinFET Devices:** The very large scale integration (VLSI) era started around the end of the '70s, driven by Moore's law which is a future prediction and an exponential law. The trend is related to the scaling of the dimensions of the single device, especially in CMOS technology. FET and MOSFET transistors, and more particularly the invention related to field effect transistors having channel regions extending vertically from a supporting substrate between horizontally disposed source and drain regions.

• **Gate Technology:** Present-generation MOSFETs are characterized by lengths on the order of few tens of nanometers. The substrate doping

1.5 Interconnect Technology

Packaging and 3D-assembly technology (TSV): This is Samsung process but today it is used by many procedures. The idea is to

stack and connect different DIEs together. Usually DIEs are 600_800µm thick; the active region is located few nanometers below the surface while all the remaining part is used just as mechanical support. It is possible to remove many microns of silicon thinning the DIE without compromising the active part of the IC. In the TSV DIEs are thinned before being connected.

• **Emerging Technology:** During the years the basic planar geometry of CMOS has almost been abandoned, and all the major procedures moved toward FINFETs and GAA.FETs. Anyway FINFETs and GAA.FETs technologies are continuously challenged by market's requirement, which eagerly demands for smaller and smaller devices, with better performances and lower power consumption. For all these reasons new paradigms for transistors operations, rather than technological boosters for old technologies are being studied.

2. Result

As a result for future, Electronics systems have been a mixture of analog, digital and nano, molecules circuit design.

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