

Microchip



**ASSIGN
BUSTER**

INTRODUCTION TO THE TOPIC

A microchip (sometimes just called a “ chip”) is a unit of packaged computer circuitry (usually called an integrated circuit) that is manufactured from a material such as silicon at a very small scale. Microchips are made for program logic (logic or microprocessor chips) and for computer memory (memory or RAM chips). Microchips are also made that include both logic and memory and for special purposes such as analog-to-digital conversion, bit slicing, and gateways.

INTEGRATED CIRCUITS

An integrated circuit consist of single crystal chip of silicon, typically 50 by 50 mils in cross section , containg both active and passive elements and their inter connection . such circuits are produced by the same processes used to fabricate individual transistors and diodes . these processes include epitaxial growth , masked impurity diffusion , oxide growth, and oxide etching using photolithography for pattern definition . A method of batch processing is used which offers excellent repeatability and is adaptable to the production of large numbers of integrated circuits at low cost. The main benefits derived from this technology are high reliability, size reduction, and low cost , as compared with the use discrete components inter connected by conventional techniques.

MORE ABOUT INTEGRATED CIRCUITS

In electronics, an integrated circuit (also known as IC, microcircuit, microchip, silicon chip, or chip) is a miniaturized electronic circuit (consisting mainly of semiconductor devices, as well as passive components) that has been manufactured in the surface of a thin substrate of semiconductor

material. Integrated circuits are used in almost all electronic equipment in use today and have revolutionized the world of electronics.

A hybrid integrated circuit is a miniaturized electronic circuit constructed of individual semiconductor devices, as well as passive components, bonded to a substrate or circuit board.

INTRODUCTION OF INTEGRATED CIRCUIT

Synthetic detail of an integrated circuit through four layers of planarized copper interconnect, down to the polysilicon (pink), wells (greyish), and substrate (green).

Integrated circuits were made possible by experimental discoveries which showed that semiconductor devices could perform the functions of vacuum tubes, and by mid-20th-century technology advancements in semiconductor device fabrication. The integration of large numbers of tiny transistors into a small chip was an enormous improvement over the manual assembly of circuits using discrete electronic components. The integrated circuit's mass production capability, reliability, and building-block approach to circuit design ensured the rapid adoption of standardized ICs in place of designs using discrete transistors.

There are two main advantages of ICs over discrete circuits: cost and performance. Cost is low because the chips, with all their components, are printed as a unit by photolithography and not constructed one transistor at a time. Furthermore, much less material is used to construct a circuit as a packaged IC die than as a discrete circuit. Performance is high since the components switch quickly and consume little power (compared to their

discrete counterparts) because the components are small and close together. As of 2006, chip areas range from a few square millimeters to around 350mm², with up to 1 million transistors per mm².

Invention

Jack Kilby's original integrated circuit

The idea of an integrated circuit was conceived by a radar scientist working for the Royal Radar Establishment of the British Ministry of Defence, Geoffrey W. A. Dummer (1909-2002), who published it at the Symposium on Progress in Quality Electronic Components in Washington, D. C. on May 7, 1952.[1] He gave many symposia publicly to propagate his ideas.

Dummer unsuccessfully attempted to build such a circuit in 1956. The integrated circuit can be credited as being invented by both Jack Kilby of Texas Instruments[2] and Robert Noyce of Fairchild Semiconductor working independently of each other. Kilby recorded his initial ideas concerning the integrated circuit in July 1958 and successfully demonstrated the first working integrated circuit on September 12, 1958. In his patent application of February 6, 1959, Kilby described his new device as “ a body of semiconductor material ... wherein all the components of the electronic circuit are completely integrated.”

CATEGORIES OF INTEGRATED CIRCUITS BASED ON PACKING DENSITY

SSI(Small scale integration) refers to integration levels typically having about 12 equivalent gates on chip. they are available in 14 or 16 pin DIP or Flat packs.

MSI(Medium scale integration) means integration typically between 12 and 100 equivalent gates per IC package. It is available in 24-pin DIP or Flat pack or 28-pin ceramic chip carrier package.

LSI(Large scale integration) implies integration typically up to 1000 equivalent gates per IC package. It includes memories and microprocessor circuits.

VLSI(Very large scale integration) means integration levels with extra high number of gates, say up to 1, 00, 000 gates per chip . For example , a RAM may have more than 4000 gates in a single chip, which is why it comes under the category of VLSI device.

METHODOLOGY

How a microchip is made?

Microchips are built from wafers that consist of 99.9% pure silicon. The silicon is made from common beach sand.

The chips are made in incredibly clean environments – the air is more than 1000 times purer than that of a hospital.

The silicon wafers are produced by a specialist company and sent to the chip manufacturer for processing.

The Silicon wafer consists of 4 layers.

A mask that is created during the design phase defines the circuit pattern.

A mask is placed over the wafer, under a UV light. Patterns are repeatedly projected on the wafer, light can only reach the wafer through the openings.

The UV light reacts with the photoresist to create the circuit patterns.

Impurities are then implanted into areas of the wafer to alter the electrical properties of specific regions. This is called doping.

Electrical contacts are formed by masking and etching the wafer to provide links between the different layers.

Multiple layers of metal are applied to form the electrical connections between the chips's layers.

The final chip is housed in a protective case that contains wires to connect it to the computer's circuit boards.

APPLICATIONS

Polymerase chain reactions (PCRs) were carried out on as many as four DNA samples at a time on a microchip device. The PCR products were then analyzed, either individually or together on the same device, by microchip gel electrophoresis. A standard PCR protocol was used to amplify 199- and 500-base pair (bp) regions of bacteriophage λ DNA and 346- and 410- bp regions of E. coli genomic and plasmid DNAs, respectively. Thermal lysis of the bacteria was integrated into the PCR cycle. A product sizing medium, poly(dimethylacrylamide), and an intercalating dye for fluorescence detection were used in the electrophoretic analysis of the products. PCR product sizes were determined by coelectrophoresis with marker DNA.

New microchip technology performs 1, 000 chemical reactions at once

Flasks, beakers and hot plates may soon be a thing of the past in chemistry labs. Instead of handling a few experiments on a bench top, scientists may simply pop a microchip into a computer and instantly run thousands of chemical reactions, with results— literally shrinking the lab down to the size of a thumbnail.

Toward that end, UCLA researchers have developed technology to perform more than a thousand chemical reactions at once on a stamp-size, PC-controlled microchip, which could accelerate the identification of potential drug candidates for treating diseases like cancer.

A team of UCLA chemists, biologists and engineers collaborated on the technology, which is based on microfluidics— the utilization of miniaturized devices to automatically handle and channel tiny amounts of liquids and chemicals invisible to the eye. The chemical reactions were performed using in situ click chemistry, a technique often used to identify potential drug molecules that bind tightly to protein enzymes to either activate or inhibit an effect in a cell, and were analyzed using mass spectrometry.

While traditionally only a few chemical reactions could be produced on a chip, the research team pioneered a way to instigate multiple reactions, thus offering a new method to quickly screen which drug molecules may work most effectively with a targeted protein enzyme. In this study, scientists produced a chip capable of conducting 1,024 reactions simultaneously, which, in a test system, ably identified potent inhibitors to the enzyme bovine carbonic anhydrase.

A thousand cycles of complex processes, including controlled sampling and mixing of a library of reagents and sequential microchannel rinsing, all took place on the microchip device and were completed in just a few hours. At the moment, the UCLA team is restricted to analyzing the reaction results off-line, but in future, they intend to automate this aspect of the work as well.

“The precious enzyme molecules required for a single in situ click reaction in a traditional lab now can be split into hundreds of duplicates for performing hundreds of reactions in parallel, thus revolutionizing the laboratory process, reducing reagent consumption and accelerating the process for identifying potential drug candidates,” said study author Hsian-Rong Tseng, a researcher at UCLA’s Crump Institute for Molecular Imaging, an associate professor of molecular and medical pharmacology at the David Geffen School of Medicine at UCLA, and a member of the California NanoSystems Institute at UCLA.

Kym F. Faull, director of the Pasarow Mass Spectrometry Lab at UCLA, helped the team with several challenges, including reducing the amount of chemicals needed for reactions on the chip, enhancing test sensitivity and speeding up reaction analysis.

“The system allows researchers to not only test compounds quicker but uses only tiny amounts of materials, which greatly reduces lab time and costs,” said Faull, a professor of psychiatry and biobehavioral sciences at the Geffen School of Medicine.

Next steps for the team include exploring the use of this microchip technology for other screening reactions in which chemicals and material

<https://assignbuster.com/microchip/>

samples are in limited supply — for example, with a class of protein enzymes called kinases, which play critical roles in the malignant transformation of cancer.

According to the researchers, the technology may open up many areas for biological and medicinal study.

The study team relied on work in the UCLA labs of Michael E. Phelps, Norton Simon Professor and chair of molecular and medical pharmacology, and Clifton K. F. Shen, assistant professor of molecular and medical pharmacology. Key research contributors included Yanju Wang, Wei-Yu Lin and Kan Liu, who work in Tseng's lab and intend to continue this line of research in independent careers after completing their training with Tseng.

The study was funded by the U. S. Department of Energy and the National Institutes of Health.

Other authors include: Rachel J. Lin of UCLA's Crump Institute for Molecular Imaging; Matthias Selke of the department of chemistry and biochemistry at California State University, Los Angeles; Hartmuth C. Kolb of Siemens Medical Solutions; Nangang Zhang of UCLA's Crump Institute for Molecular Imaging and the department of physics and Center of Nanoscience and Nanotechnology at China's Wuhan University; and Xing-Zhong Zhao of the department of physics and Center of Nanoscience and Nanotechnology at China's Wuhan University

USE OF MICROCHIPS

Solvents use in microchip production

What is the role of solvents in microchip production?

The microelectronics industry uses electronic-grade solvents, meaning there are very low levels of metal ions in the solvents, to produce microchips.

Metal ions can cause short circuits that result in “ bad” microchips.

Electronic-grade solvents are used to dissolve a photo-sensitive polymer that is then spun on a silicon wafer to produce the microcircuitry. Solvents also are used to clean the surface of wafers and circuits. Common solvent groups used in producing microchips are alcohols, esters and ketones.

Making integrated circuits is a multi-layer, multi-step process. Solvents play a critical role in transferring the circuit pattern onto the chip. Photo-resistant resins are dissolved in a solvent and spin-coated on the wafer. The circuit is then exposed onto the surface through a mask. The non-exposed surface is etched away and the resulting circuit is complete. In this way extremely small circuitry can be transferred to the wafers. As technology progresses, smaller and smaller circuits are needed, and the types of resins used are ever changing. Solvents are playing an important role in making sure that these new polymer resins can be coated and spun in the same way the existing resins are used today.

High-purity grades of solvents help reduce failures per circuit. In turn, this helps reduce waste and improves the efficiency of microchip production

RESULT

A microchip will be the next source of experiments doing in faster way. This use of microchips in chemistry laboratories can become a revolution . After

some years of development in science and technology , we will be going to see experiments performing in faster way comparing to these days.

DISCUSSION AND SUMMARY

Microchip , made of integrated circuits can perform the experiments.

Integrated circuits are made of semiconductors which are made from silicon or germanium ion. Now a days we are using flasks, beakers, etc. in labs.

These can be done simply by putting all the materials, chemicals etc. on a single chip. With this , scientists can perform thousands of reactions in a little bit of time. The experiments will become more easier and complexity will go to minimum.

It can have all these advantages but also has disadvantages. With microchip experiment , the experiment will be faster but error chances will be more.

The result we can see by doing ourselves.