Very-large-scale integration

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Very-large-scale integration (VLSI) is the process of creating integrated circuits by combining thousands of transistor-based circuits into a single chip. VLSI began in the 1970s when complex semiconductor and communication technologies were being developed. The microprocessor is a VLSI device. The term is no longer as common as it once was, as chips have increased in complexity into the hundreds of millions of transistors.

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Overview

The first semiconductor chips held one transistor each. Subsequent advances added more and more transistors, and as a consequence more individual functions or systems were integrated over time. The first integrated circuits held only a few devices, perhaps as many as ten diodes, transistors, resistors and capacitors, making it possible to fabricate one or more logic gates on a single device. Now known retrospectively as "small-scale integration" (SSI), improvements in technique led to devices with hundreds of logic gates, known as large-scale integration (LSI), i.e. systems with at least a thousand logic gates. Current technology has moved far past this mark and today's microprocessors have many millions of gates and hundreds of millions of individual transistors.

As of early 2008, billion-transistor processors are commercially available, an example of which is Intel's Montecito Itanium chip. This is expected to become more commonplace as semiconductor fabrication moves from the current generation of 65 nm processes to the next 45 nm generations.

At one time, there was an effort to name and calibrate various levels of large-scale integration above VLSI. Terms like **Ultra-large-scale Integration (ULSI)** were used. But the huge number of gates and transistors available on common devices has rendered such fine distinctions moot. Terms suggesting greater than VLSI levels of integration are no longer in widespread use. Even **VLSI** is now somewhat quaint, given the common assumption that all microprocessors are VLSI or better.

Notable VLSI companies

- Advanced Micro Devices (AMD)
- Altera
- Analog Devices
- ARM Ltd

- Aricent
- ATI Technologies
- Austria Microsystems
- Broadcom
- Chartered Semiconductor Manufacturing
- Conexant
- Cypress Semiconductor
- Dalsa
- e-Infochips
- Freescale Semiconductor
- IBM
- Infineon
- Intel
- KPIT Cummins
- Lattice Semiconductor
- Linear Technology
- Marvell Technology Group
- Micron Technology
- National Semiconductor
- NEC
- NeoMagic
- Nvidia
- NXP Semiconductors
- Portal Player
- Qualcomm
- Rambus
- Renesas Technology
- Samsung Electronics
- Sandisk
- Sarnoff
- Sasken Communication Technologies Limited
- ST Microelectronics
- Tata Elxsi
- Texas Instruments
- Toshiba
- TSMC
- UMC

VLSI journals

- TVLSI – IEEE Transactions on Very Large Scale Integration (VLSI) Systems
- JSSC – IEEE Journal of Solid State Circuits
- ED – IEEE Transactions on Electron Devices
- TCAD – IEEE Transactions on Computer-Aided DESIGN of Integrated Circuits and Systems
- TODAES – ACM Transactions on Design Automation of Electronic System

VLSI conferences

- ISSCC – IEEE International Solid-State Circuits Conference
- CICC – IEEE Custom Integrated Circuit Conference
- ISCAS – IEEE International Symposium on Circuits and Systems
- VLSI – IEEE International Conference on VLSI Design
- DAC – Design Automation Conference
- ICCAD – International Conference on Computer-Aided Design
- ESSCIRC – European Solid-State Circuits Conference

- ISLPED – International Symposium on Low Power Electronics and Design
- ISPD – International Symposium on Physical Design
- ISQED – International Symposium on Quality Electronic Design
- DATE – Design Automation and Test in Europe
- ICCD – International Conference on Computer Design
- IEDM – IEEE International Electron Devices Meeting
- GLSVLSI – IEEE Great Lakes Symposium on VLSI
- ASP-DAC – Asia and South Pacific Design Automation Conference
- MWSCAS – IEEE Midwest Symposium on Circuits and Systems
- ICSVLSI – IEEE Computer Society Annual Symposium on VLSI
- VLSI-SOC – [1] IFIP WG10.5
- IEEE Symposia on VLSI Circuits and Technology

See also

- ASIC
- Carver Mead
- Design Rules Checking
- EDA
- Lynn Conway

Further reading

- Carver Mead & Lynn Conway. *Introduction to VLSI Systems.* (Addison-Wesley, 1980)
- Chen, Wai-Kai (ed). *The VLSI handbook*. CRC/Taylor and Francis: 2007, 2nd edition. ISBN 084934199X.
- Weste, Neil H.E. & Harris, David. *CMOS VLSI Design.* (Addison-Wesley, 3rd Edition)
- VLSI-Design of Integrated Circuits Lecture Material at Darmstadt University of Technology

External links

- Lectures on Design and Implementation of VLSI Systems at Brown University
- Design of VLSI Systems
- Association of fabless Semiconductor Companies
- CMOS Textbooks
- List of VLSI companies around the world
- VLSI discussion portal

Software

- LASI General Purpose VLSI IC layout and design system
- VLSI Layout 3D - Visualization Software for LASI
- Fedora Electronic Lab