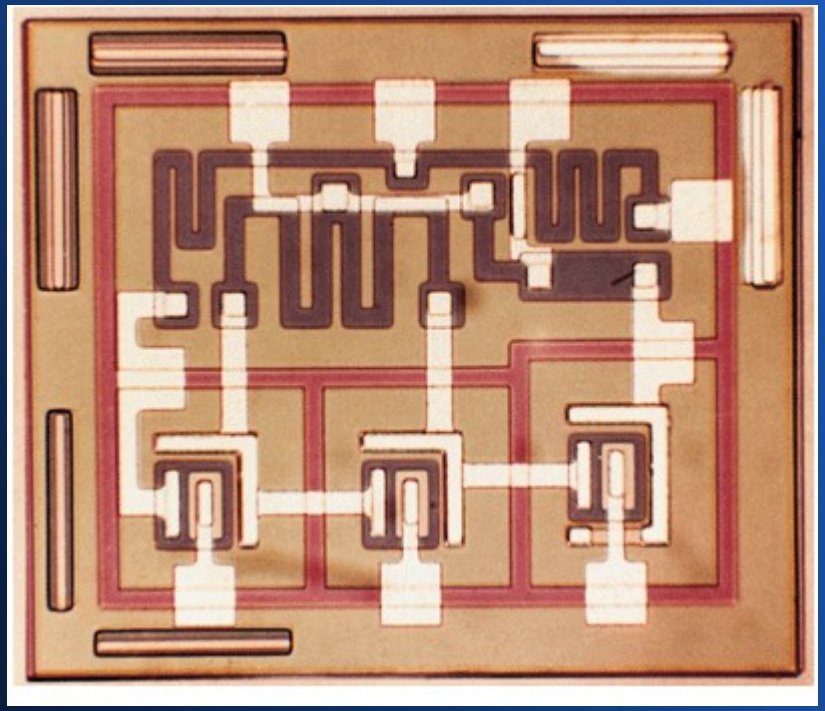
CSU11026 Digital Logic Design

Assessment structure
Online Exam: An exam that will be released to students at a time determined
by College and that students will have 2 hours to complete.

https://www.scss.tcd.ie/John.Waldron/CSU11026/CSU11026.html

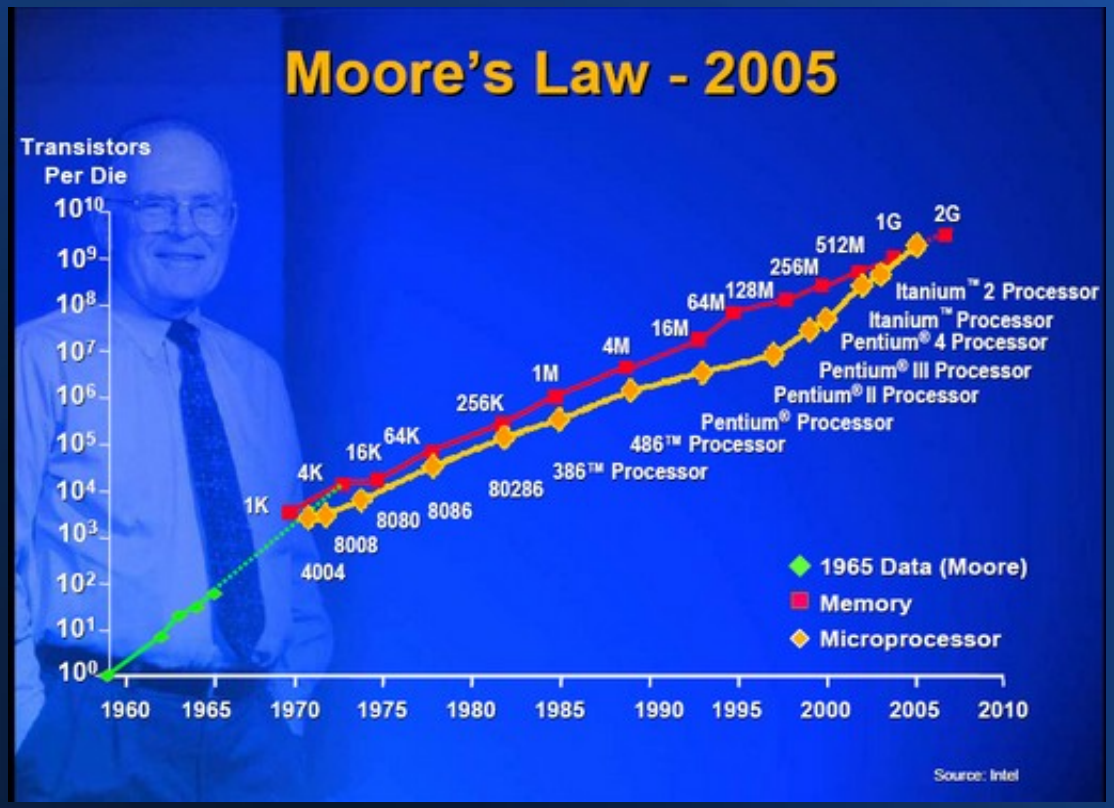
This amplifier circuit from Siemens was mass produced in 1965. Containing three transistors and five resistors on a 1.5 mm square chip



15-Core Xeon Ivy Bridge-EX, Transistor count = 4,310,000,000
22 nm process, 23 mm x 23mm = 541 square mm

The transistor count of a device is the number of transistors in the device. Transistor count is the most common measure of integrated circuit complexity. According to Moore's Law, the transistor count of the integrated circuits doubles every two years.

On most modern microprocessors, the majority of transistors are contained in caches.

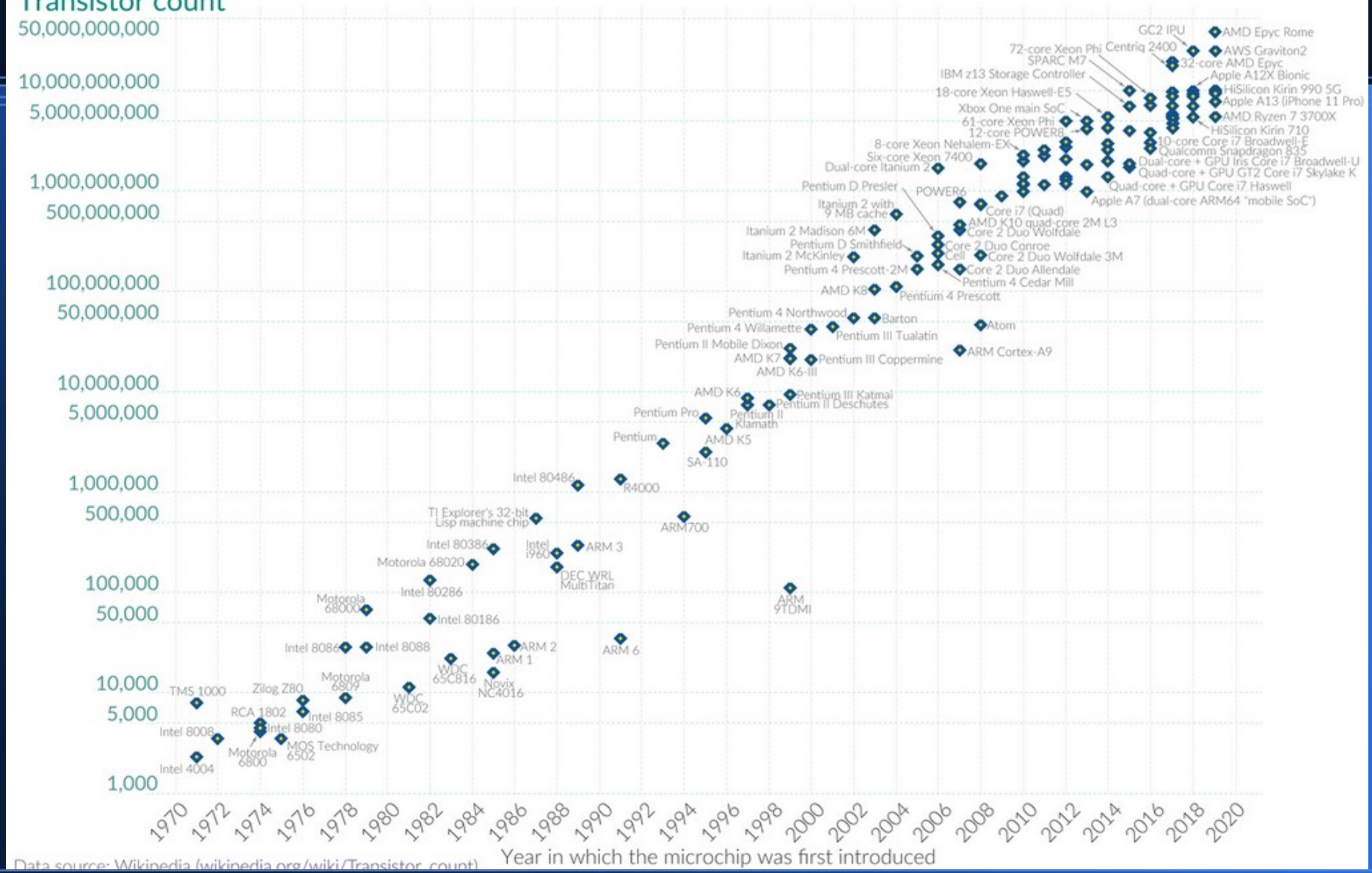


ICs can be made very compact, having up to several billion transistors and other electronic components in an area the size of a fingernail.

Moore's Law: The number of transistors on microchips doubles every two years

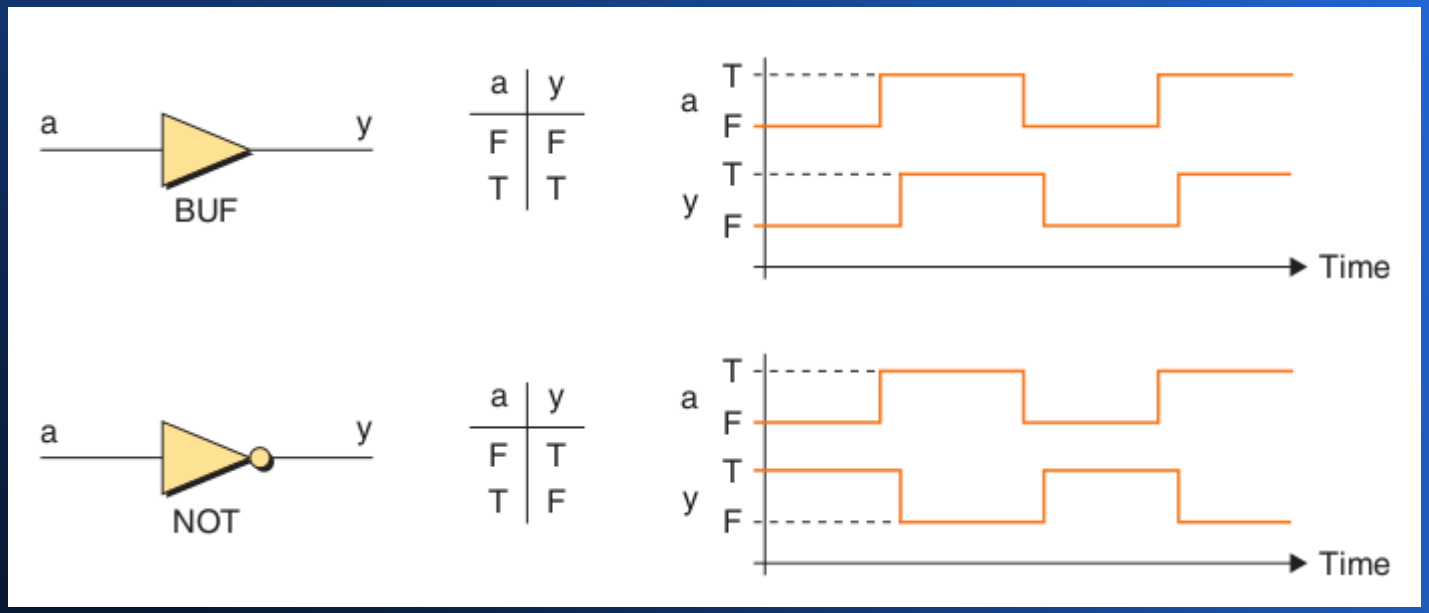
Our World in Data

Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important for other aspects of technological progress in computing – such as processing speed or the price of computers.

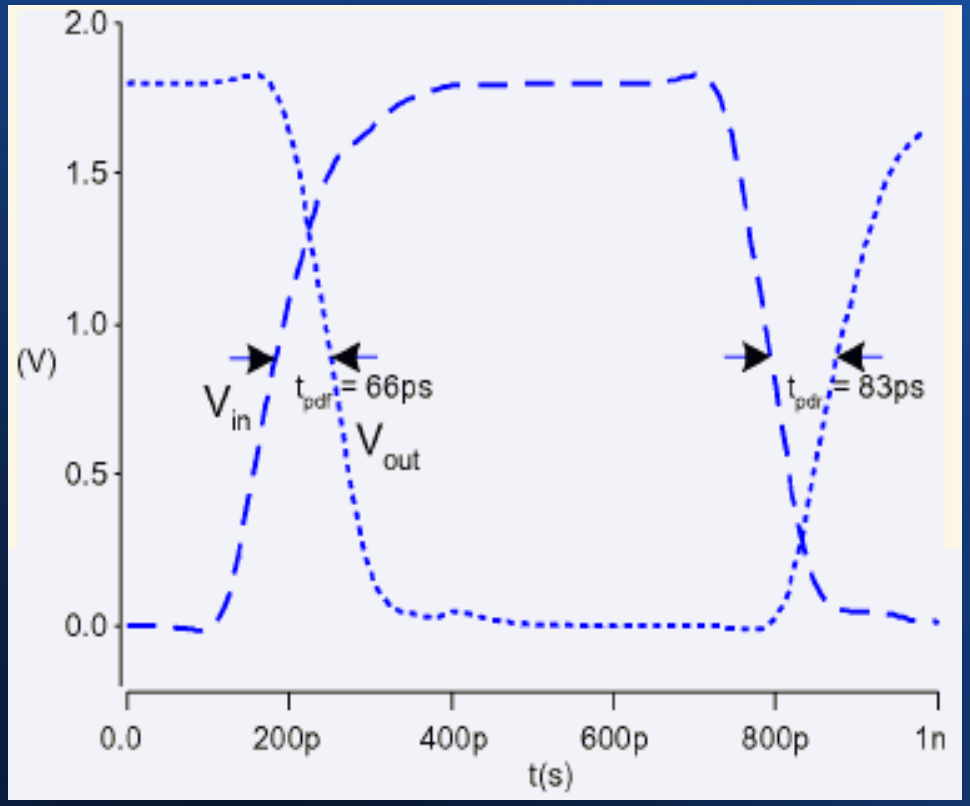


Data source: Wikipedia (wikipedia.org/wiki/Transistor_count)

BUF and NOT functions



Inverter Delay



t_{pdr}: rising propagation delay

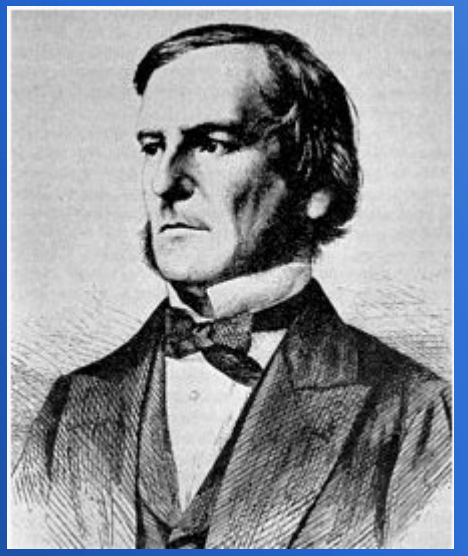
- From input to rising output crossing $V_{DD}/2$

t_{pdf}: falling propagation delay

- From input to falling output crossing $V_{DD}/2$

Pico is a unit prefix in the metric system denoting one trillionth, a factor of 10^−12 (0.000000000001). this was one of the original 12 prefixes defined in 1960 when the International System of Units was established.

Boolean Algebra

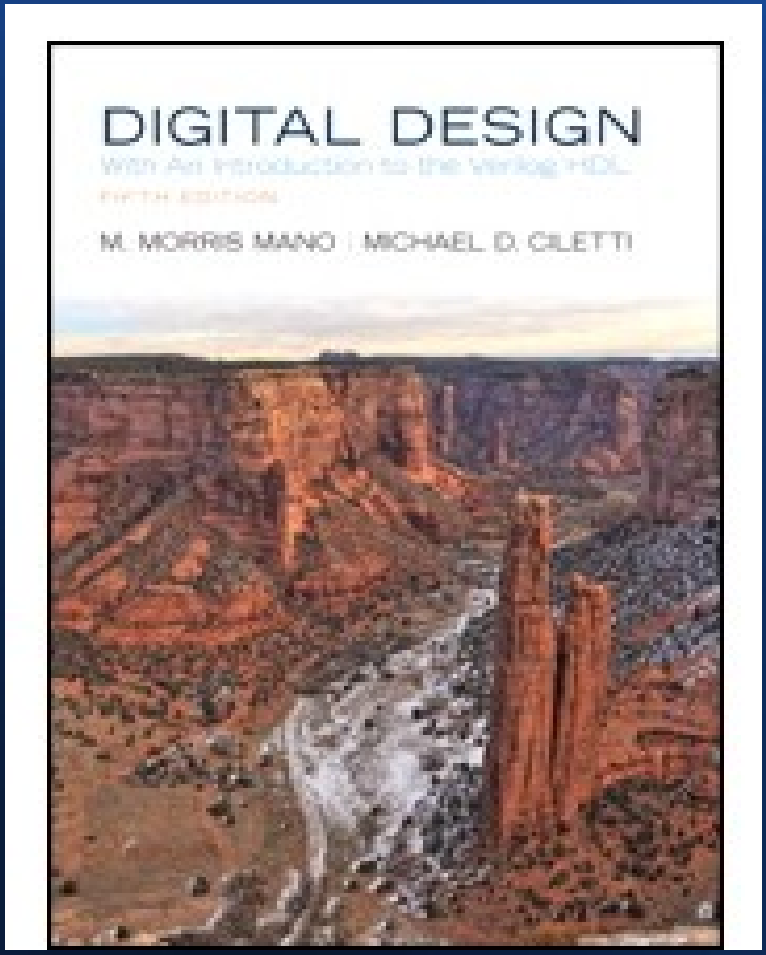


George Boole 2 November 1815 – 8 December 1864) was an English mathematician, philosopher and logician.

Appointed in 1849 as the first professor of mathematics at Queen's College, Cork in Ireland.

Developed a new form of mathematics that is now known as Boolean Algebra. Boole’s intention was to use mathematical techniques to represent and rigorously test logical and philosophical arguments. Boole established a new mathematical field known as symbolic logic.

http://www.mypearsonstore.com/bookstore/product.asp?isbn=0132774208



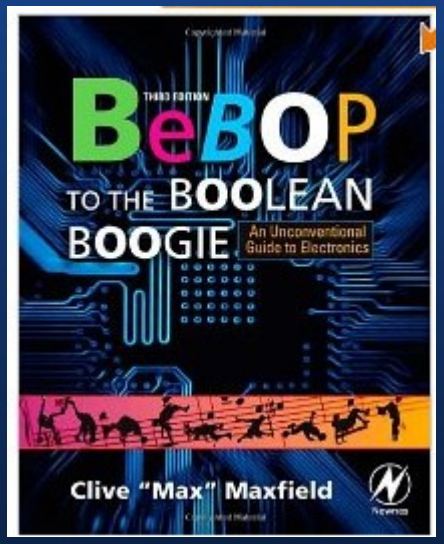
Digital Design, 5th Edition

By M. Morris Mano,
Michael D. Ciletti

Published by Prentice Hall

Published Date: Jan 2, 2012

Also recommended, written in a more informal style

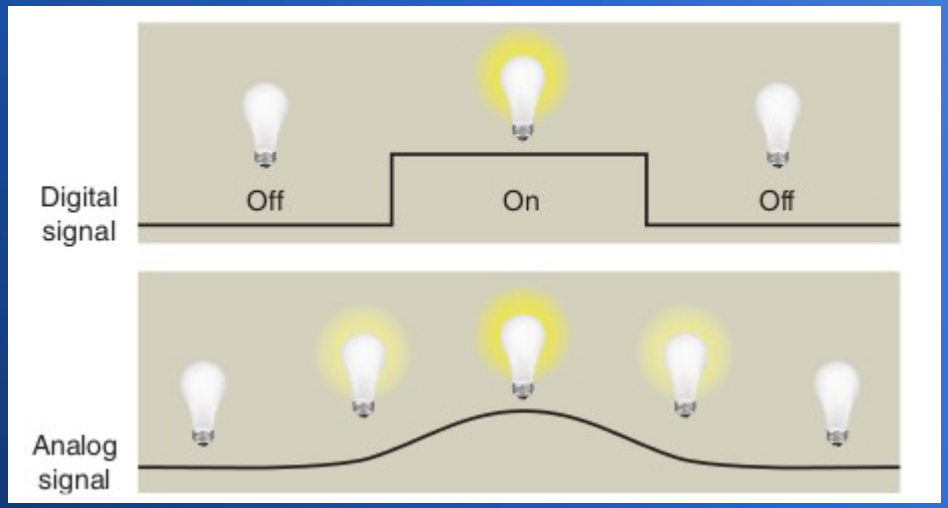


Bebop to the Boolean Boogie, Third Edition: An Unconventional Guide to Electronics

Clive Maxfield

The only electronics book in the world to include a Seafood Gumbo recipe

Publication Date: December 23, 2008 | ISBN-10: 1856175073 | ISBN-13: 978-1856175074 | Edition: 3



Digital electronics represent signals by discrete bands of analog levels, rather than by a continuous range. All levels within a band represent the same signal state. Relatively small changes to the analog signal levels due to manufacturing tolerance, signal attenuation or parasitic noise do not leave the discrete envelope, and as a result are ignored by signal state sensing circuitry.

Lithography

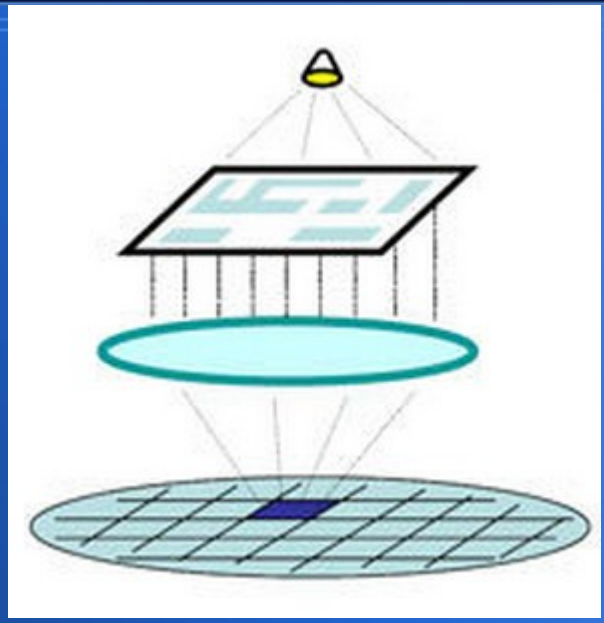
Lithography originally used an image drawn with oil, fat, or wax onto the surface of a smooth, level lithographic limestone plate.

The stone was treated with a mixture of acid and gum arabic, etching the portions of the stone which were not protected by the grease-based image.

When the stone was subsequently moistened, these etched areas retained water; an oil-based ink could then be applied and would be repelled by the water, sticking only to the original drawing.

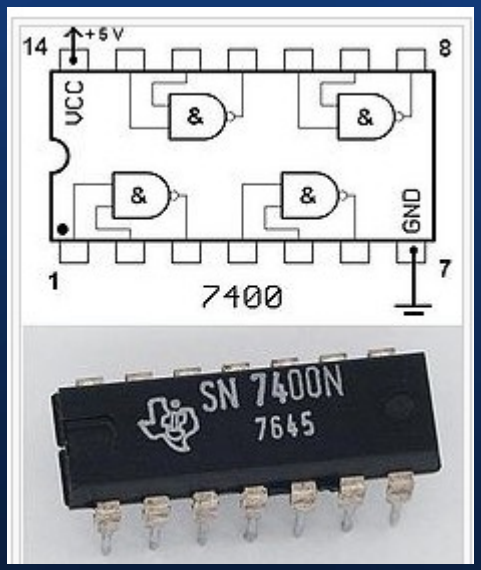
The word lithography comes from the Greek lithos, meaning stones, and graphia, meaning to write. It means quite literally writing on stones.

In the case of semiconductor photolithography, our stones are silicon wafers and our patterns are written with a light-sensitive polymer called photoresist.



To build the complex structures that make up a transistor and the many wires that connect the millions of transistors of a circuit, lithography and pattern transfer steps are repeated at least 10 times, but more typically are done 20 to 30 times to make one circuit.

Each pattern being printed on the wafer is aligned to the previously formed patterns and slowly the conductors, insulators, and selectively doped regions are built up to form the final device.


14
+5V
8
VCC
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GND
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7400
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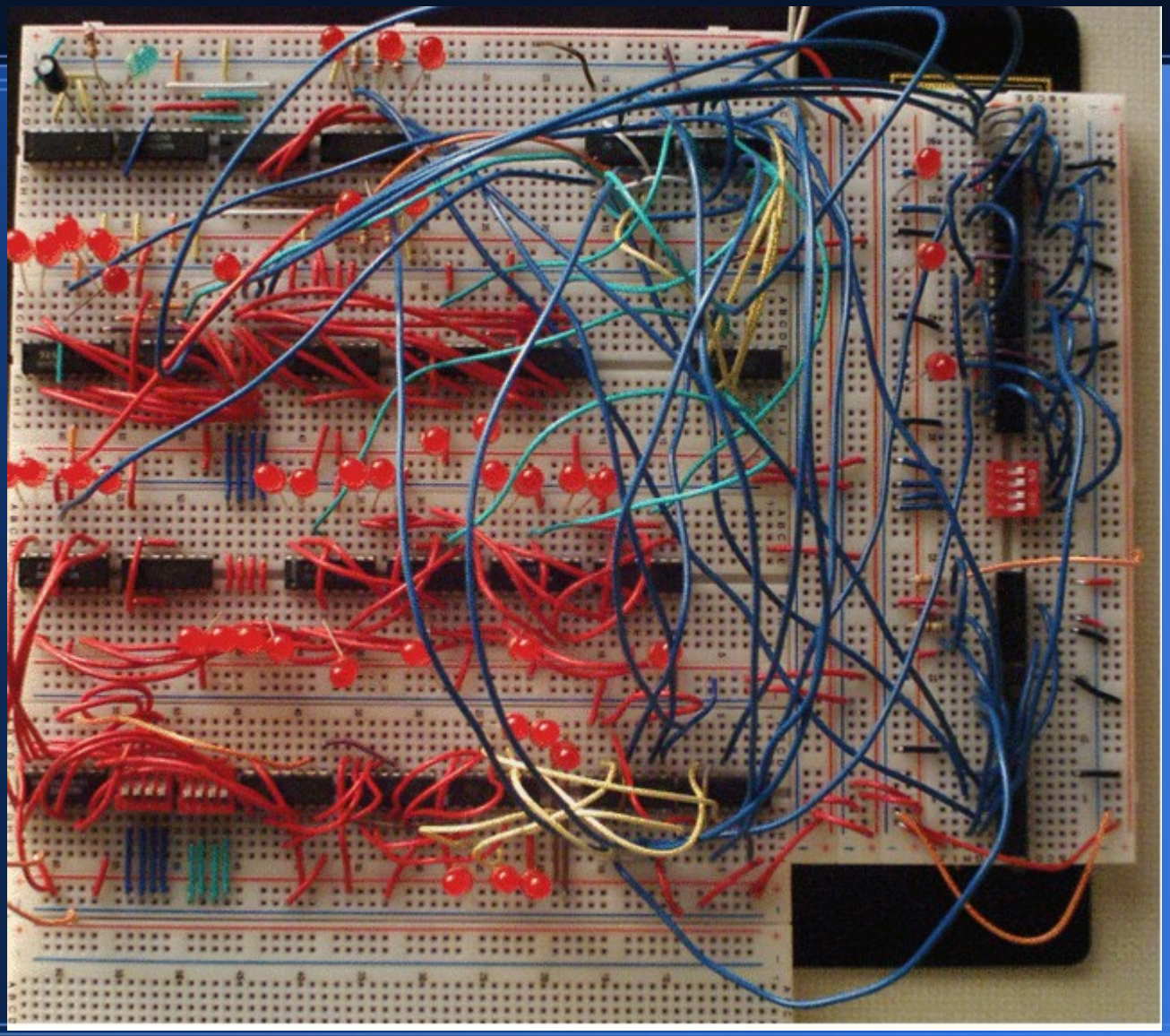
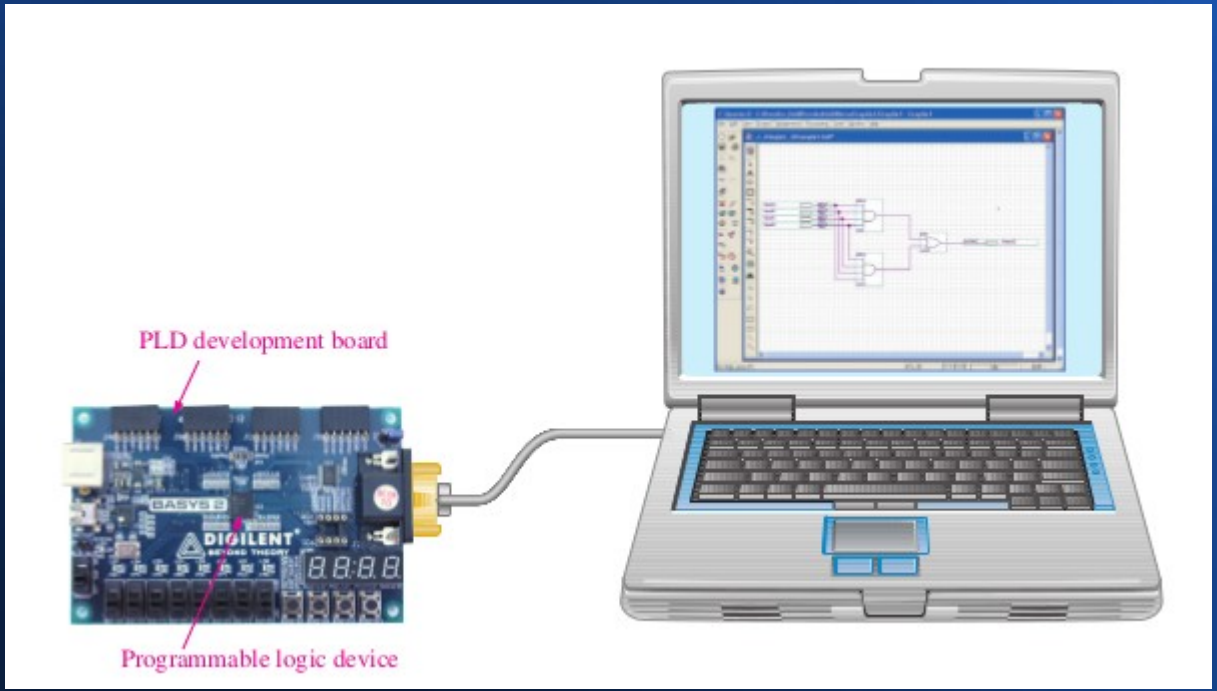
SN 7400N
7645



Verilog HDL is a hardware description language used to design and document electronic systems. Verilog HDL allows designers to design at various levels of abstraction. It is the most widely used HDL with a user community of more than 50,000 active designers.



Recommended youtube channel

https://www.youtube.com/c/BenEater