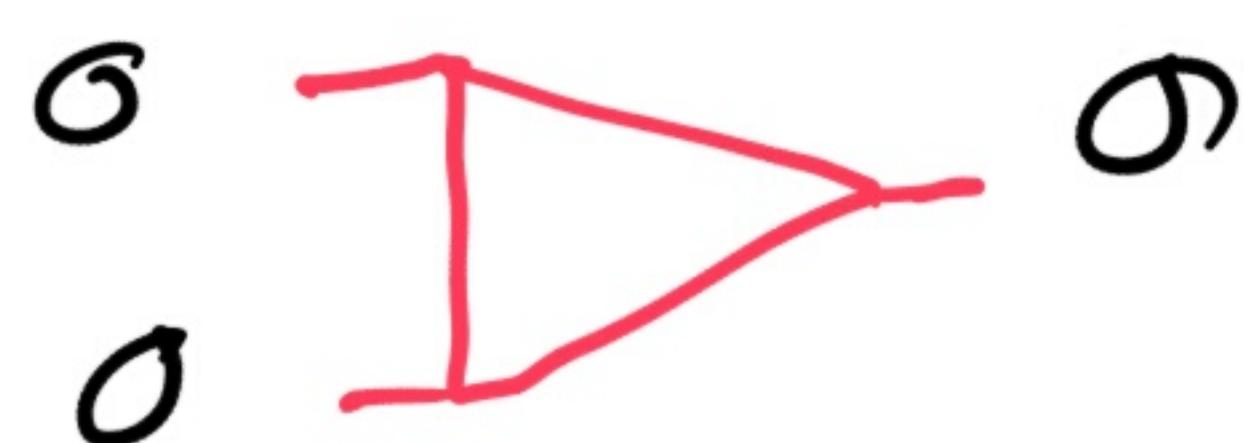
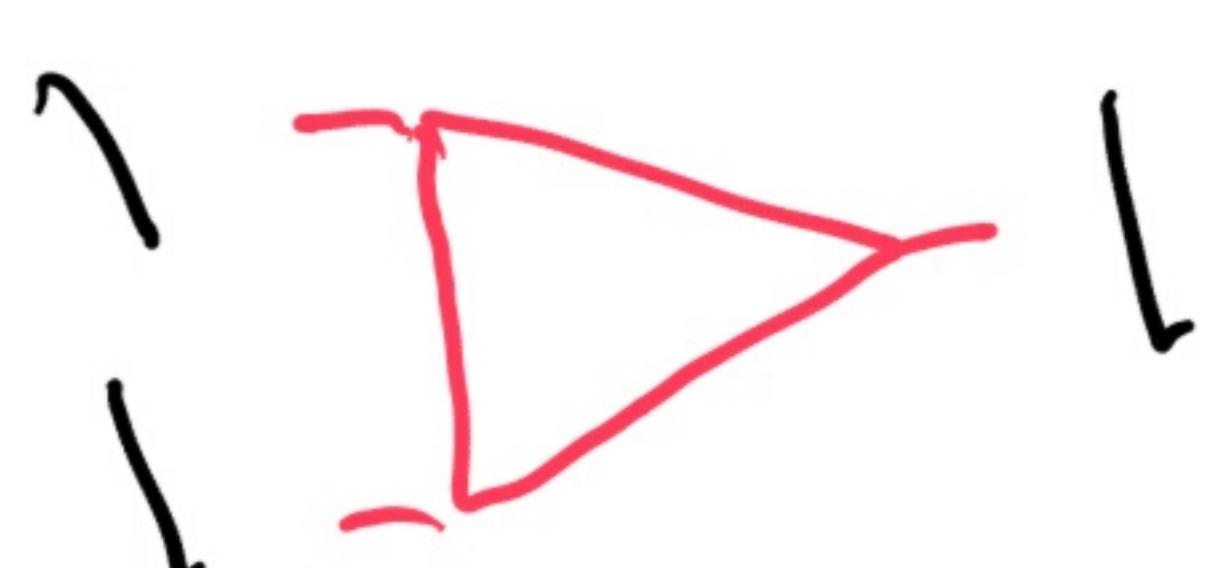
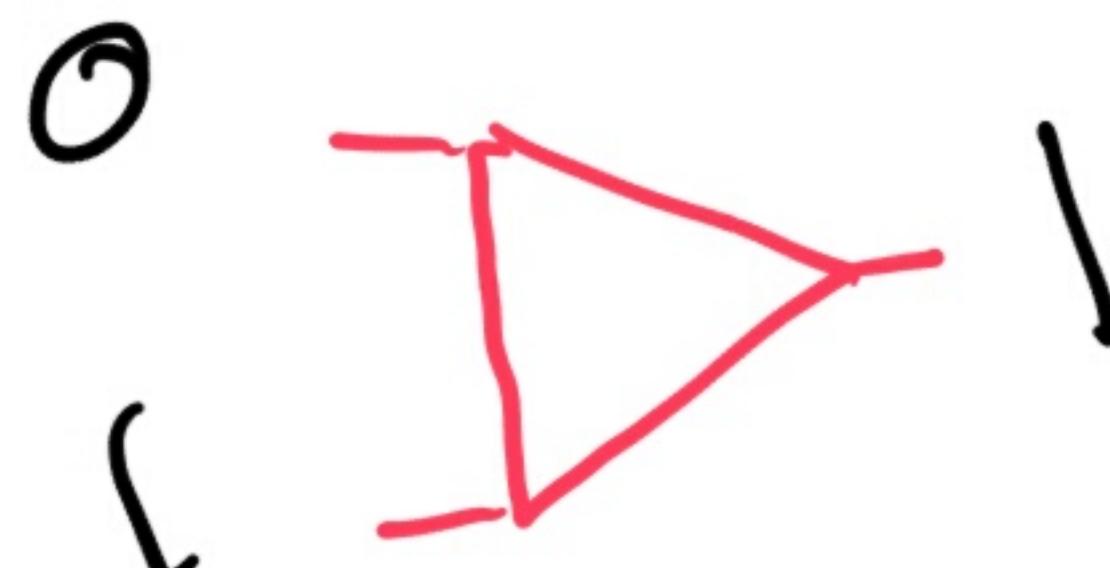
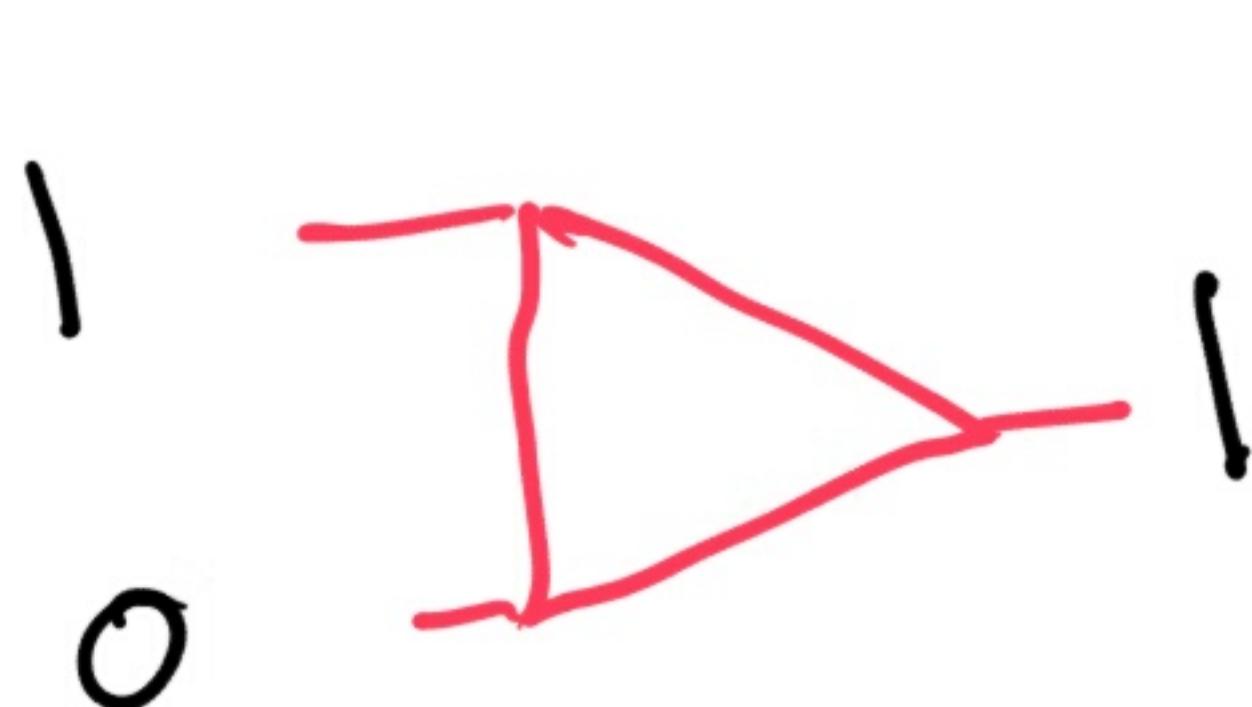


ADC :

Analog to digital Converter

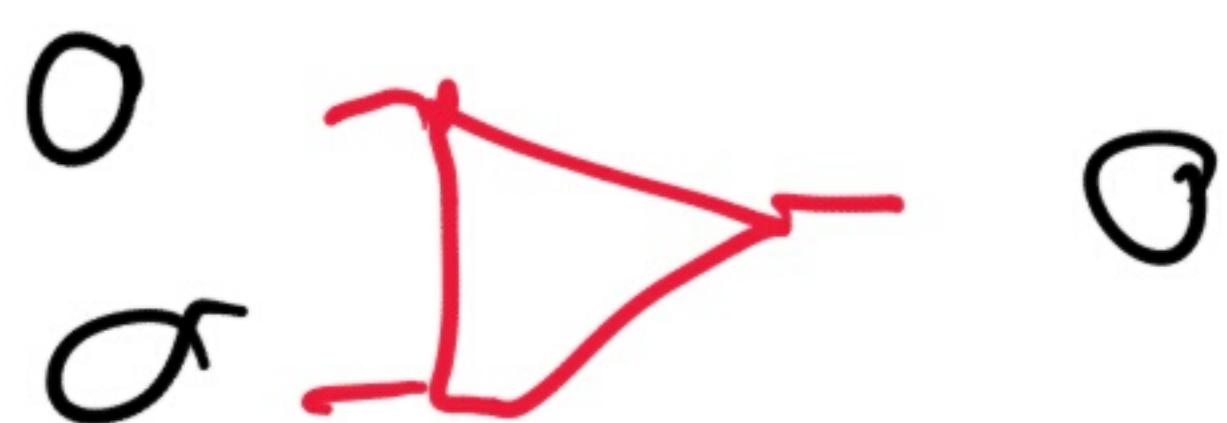
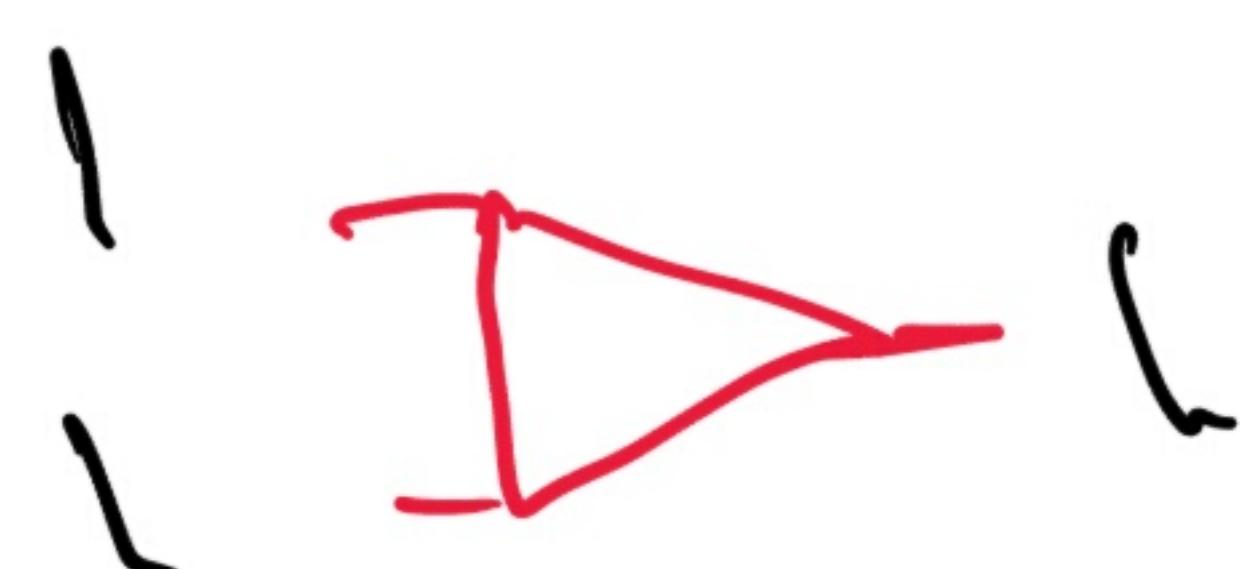
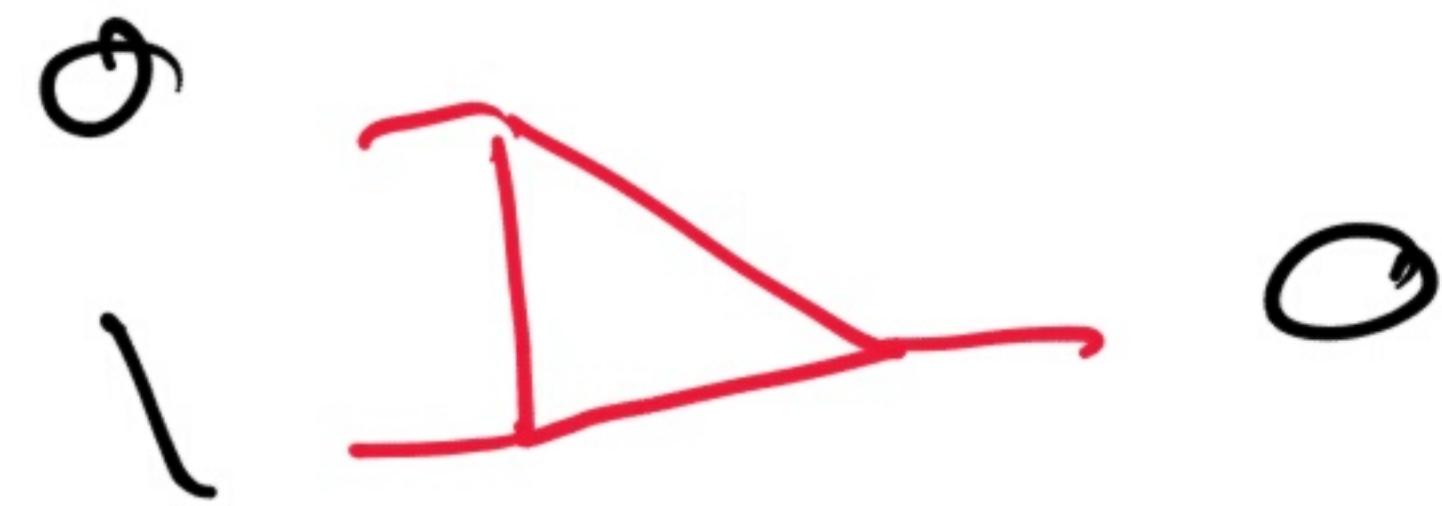
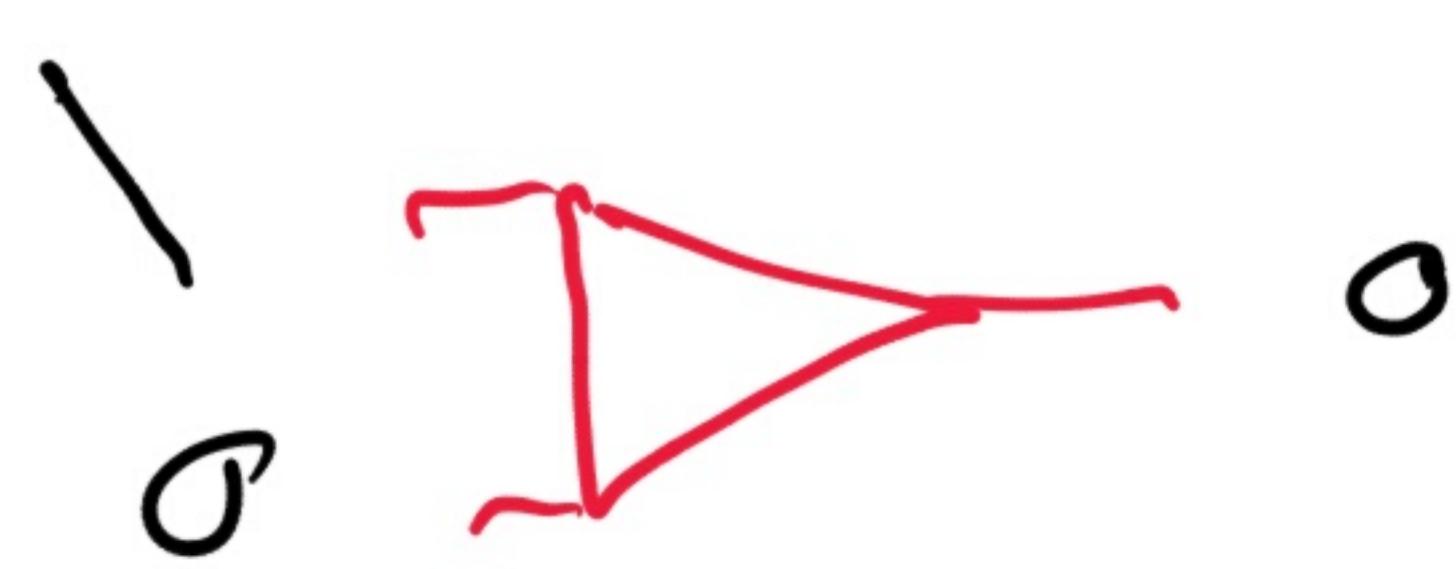
NAND gate:

control conditions:



AND gate:

control conditions:



## Digital designer:

- ① working on digital circuits  
for embedded Project.
- ② VLSI  
very Large scale integration
- ③ ASIC  
Application-specific Integration circuit
- ④ SOC  
System on chip  $\rightarrow$  ECU
- ⑤ FPGA  
Field programmable gate array
  - $\rightarrow$  System designed to test result of circuit performance
- ⑥ HDL  
hardware
  - Description Language
  - Verilog
  - VHDL

note:

- ① HDL language used for writing a code controlling a chip.  
(Likely a firmware)
- ② When coding, the code gets tested by a synthesiser which is a gate verifier that verifies the flows in the code before burning on a chip.
- ③ HDL is used by hardware designer engineer.

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and used to determine the behaviour of a circuit

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• embedded engineer can write  
a driver

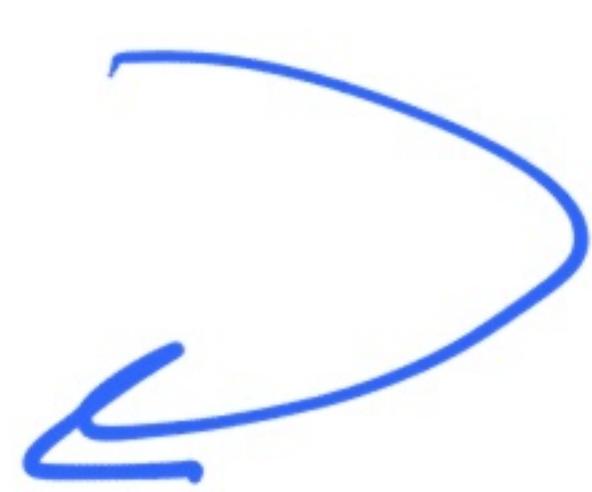
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Rtos Realtime operating system

Gpu Graphic processing unit

Programmable Logic

FPGA



## what is Embedded system

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- a special purpose system designed to perform dedicated functions and could be one or more function in one.
- Unlike Computers, Embedded system has constraints and it works as a part of a complete device that includes hardware and mechanical parts.
- what is the constraints in making micro controller (embedded constraint)
- ① Power: must be as low as possible to save functionality and maintain mobility of the system.

size: not only physical size but also the size of program written. (must not exceed size of memory)

time; must be controlled and accurate as some industries depending on accuracy. So time must be accurate as desired.

### embedded models

up to 2005: mainly depending on combining multiple chips comprising a device.

recently: with modern technologies and sizes of circuits, it became more reliable to combine multiple models of hardware in one chip.

# Embedded system Classification

system on chip (soc)

microController family

what is microController:

it is a microprocessor that connected to other peripherals

Like: bus - flash mem. - ram

GPIO (controls the input and output pins on the chip)

GIC (general Interrupt Controller)

timer - serial interface (SPI - UART - I2C)

ADC - DAC.

the max speed of microcontroller is 300 MHz

## System on chip (SoC)

Likely a(CPU), it is a microcontroller with a high performance, more speed, all embedded peripherals in microcontroller family, but with higher performance and more peripherals than the regular microcontroller.

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important note:

you have to read the specs of a micro controller carefully in a way that meets your needs.

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infotainment a module

the represented as main screen mounted on dashboard

Bare metal software

the code that have access

directly to the registers

and also called Low Level driver (L.L.D.)

operating system application

Regular software with

regular language uses driver

and interfaces not a direct

communication like Bare metal

AutoSar  
automotive open system Architecture