

Circuit schematic versus Logic Diagram

Many students are confused about what is a circuit schematic? How do you turn a logic diagram into a circuit schematic? What must a circuit schematic have, to be complete? and similar questions.

The logic diagrams what we work with in digital design have logic blocks (usually these are gates, but they may be higher level logic as well), and connections between the blocks. The diagram has inputs (labeled with names for each input) and outputs (also, each output signal is named). A logic diagram gives the implementation of the logic function, but it is not buildable, since it is missing all the practical information needed to turn it into a real circuit.

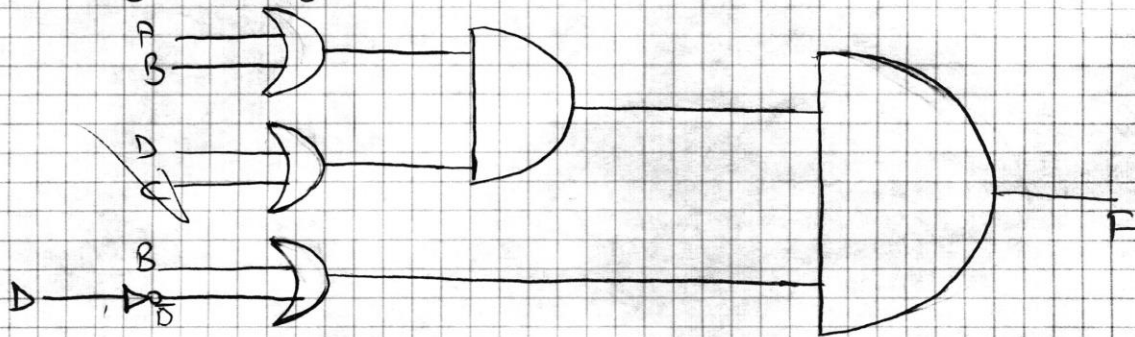
A circuit schematic for logic will contain the logic blocks (usually gates) and connections, plus the inputs and outputs of the logic diagram, plus 3 more things:

- part numbers marked on all the gates (or logic blocks) of real digital ICs
- pin numbers, obtained from the data sheet of the part, on all the inputs & outputs of every gate (or logic block) in the schematic
- pin numbers for GND and +V, taken from the data sheet of the parts, for each part that is used in the schematic

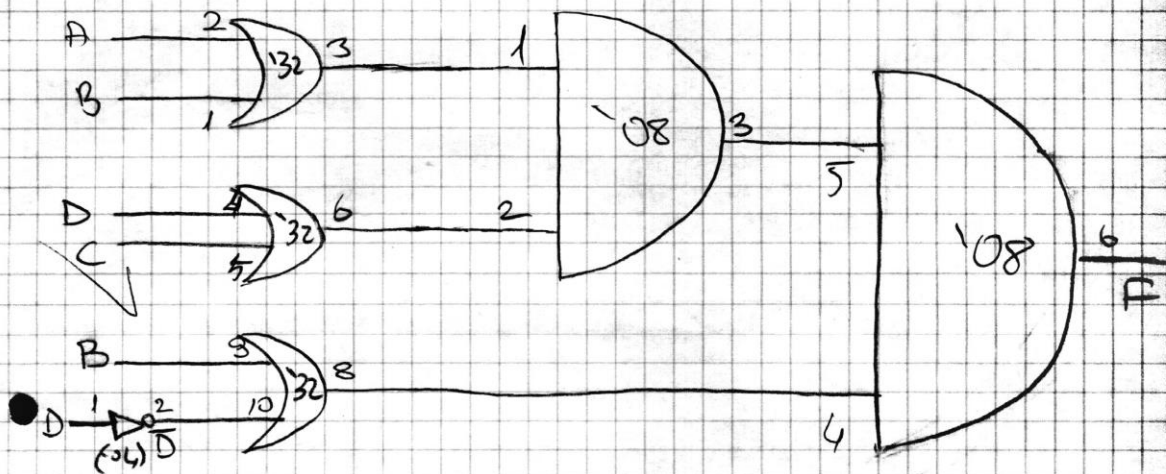
The hand drawn logic diagram on the next page is turned into a circuit schematic by the addition of these 3 things. Note that the students almost forgot to list the pin number for power and ground, but remembered to do so at the very bottom of the page, and linked it back to the rest of the circuit schematic with the * symbol. Otherwise, it would have been incomplete (and hence incorrect).

● ② $F = (A+B)(C+D)(B+\bar{D})(POS)$

* Logic Diagram



● * Circuit Schematic



** This circuit is more efficient because it is a 3-level-circuit. (The SOP-circuit has 4 levels but the same number of gates, literals and inputs!)

IC List

① One 74LS04 HEX Inverting Gate

② One 74LS08 Quad 2-Input AND Gate

③ One 74LS32 Quad 2-Input OR Gate

* 74LS04
GND - 7
+5V - 14

* 74LS08
GND - 7
+5V - 14

* 74LS32
GND - 7
+5V - 14