

Module 1 - Introduction to Digital Circuit

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1.1 Learning Objectives

After completing this module, students are expected to be able to:

- Understand how to effectively read and interpret integrated circuit (IC) datasheets, including key specifications, pin configurations, and operational parameters.
- Understand the fundamental working principles of various Integrated Circuits (ICs), their internal architectures, and common applications in electronic systems.
- Understand the function and proper usage of breadboards for prototyping electronic circuits, including best practices for component placement and wiring.

What Will We Learn?

Welcome to the world of electronics! This first module will serve as your foundational step into the practical aspects of designing and building circuits.

We will begin by focusing on the essential skills required for any electronics project. You will learn the critical process of reading and understanding component specifications through datasheets, explore the function and inner workings of Integrated Circuits (ICs), and master the use of breadboards for hands-on prototyping and experimentation. This module will provide you with the solid groundwork needed for more advanced topics to come.

1.2 Basic Components

Before we make a digital system circuit, we have to know more about what component that will be used when making a digital system.

Power Supply

Power supply is an electrical component that is used to supply electrical power for other components. Power supply that we mostly use in this lab is battery. On a battery there are two poles, the positive pole or VCC and the negative pole or GND (Ground).



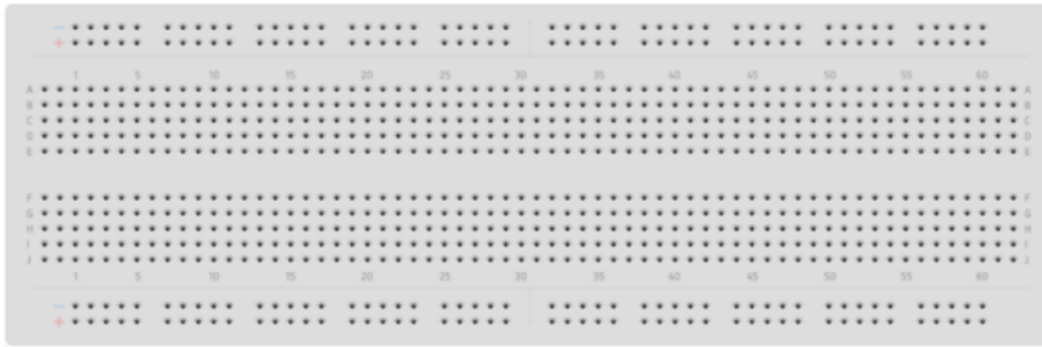
Cable

Cable (or jumper) is an electrical component that is used to connect between components, cable allows electrical current to flow from one component to another.

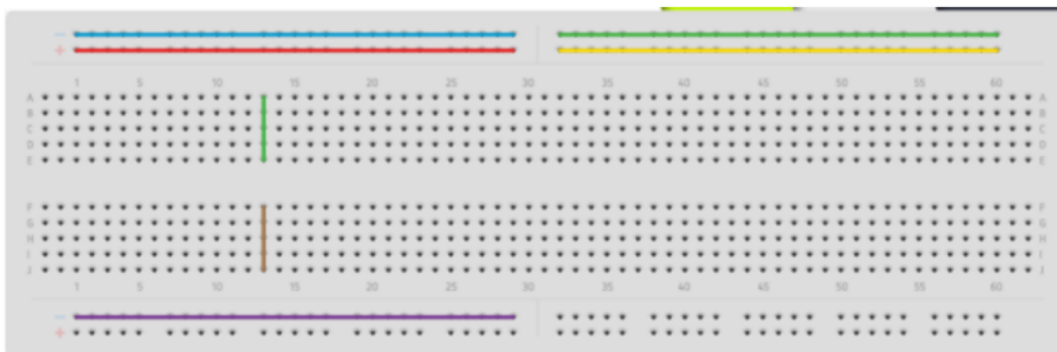
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Breadboard

Breadboard (or “Protoboard”) is a component that is used to attach electrical components such as jumper, transistor, resistor, IC etc. When using breadboards we don’t need to solder wires and components to make a circuit, because of this reason breadboards are widely used in prototyping a digital circuit.



Breadboard consists of many holes and each hole is connected in a way to a metal plate. Not all holes in the breadboard are connected to each other, here is the picture of the breadboard's hole connections.

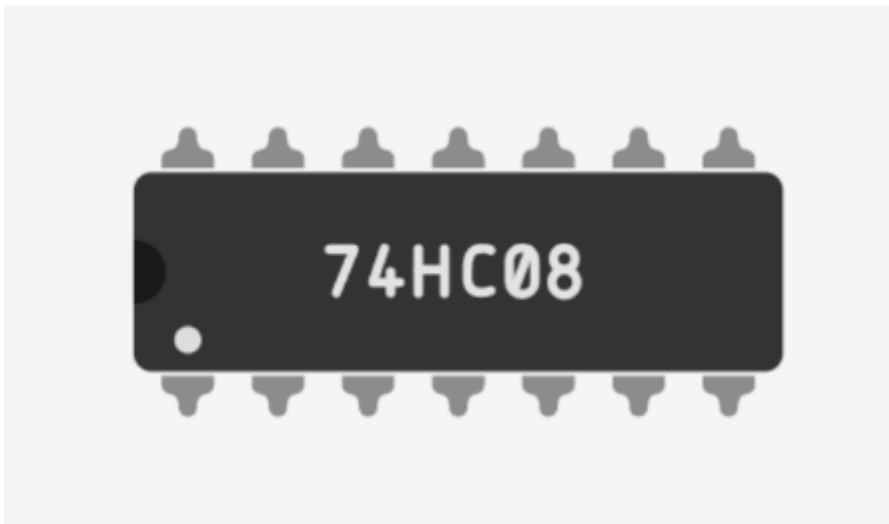


There are two kinds of connection in a breadboard, vertical and horizontal, the vertical connection is placed in the top and bottom part of the breadboard whereas the vertical connection is placed in the middle part.

If you look at the picture, holes that are connected to a line with the same color share the same connection, when one of the holes in that color is connected to an electric current the other holes from the same color lines will have the same amount of current.

Integrated Circuit

Integrated Circuit (IC) is an electrical component that consists of hundreds or even thousands of transistors, diodes, and resistors integrated to form a digital circuit that has its own function.

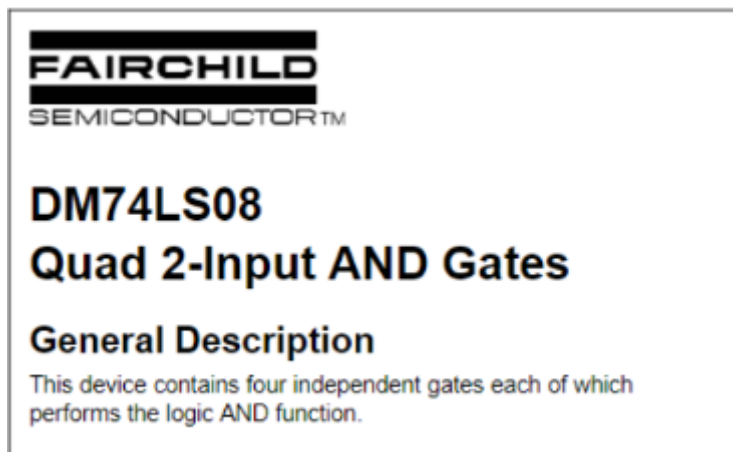


Every IC has many pins, and each pin has its own function. We can see the function of each pin from the datasheet provided by the manufacturer.

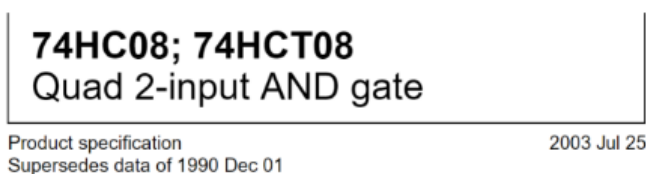
1.3 Datasheet

Datasheet is a piece of paper, in physical form or digital form, provided by the component or software manufacturer that consists of information about the product. In digital circuit design, datasheets provide information about electrical components such as IC. How to read a datasheet:

Code



From the picture above we know that the IC code is 74LS08, in order to know the main function of the IC we only have to see the number from the code, for example the number from code 74LS08 is 7408, the 7408 IC code indicates that the IC that described in the datasheet is a 2-Input AND Gates IC.



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Another example is the 74HC08 IC, despite having a different code from the 75LS08 IC the main function is still the same, both used as a 2-Input AND Gates IC. Another example that you can search for yourself is the 74LS11 IC that acts as 3-input AND gates.

Main Function

DM74LS08

Quad 2-Input AND Gates

General Description

This device contains four independent gates each of which performs the logic AND function.

The main function of an IC can be identified from the title of the datasheet, 2-Input AND gates means that every gate in the IC consists only of two inputs while Quad means that there are 4 gates in that IC.

Truth Table

Function Table

$$Y = AB$$

Inputs		Output
A	B	Y
L	L	L
L	H	L
H	L	L
H	H	H

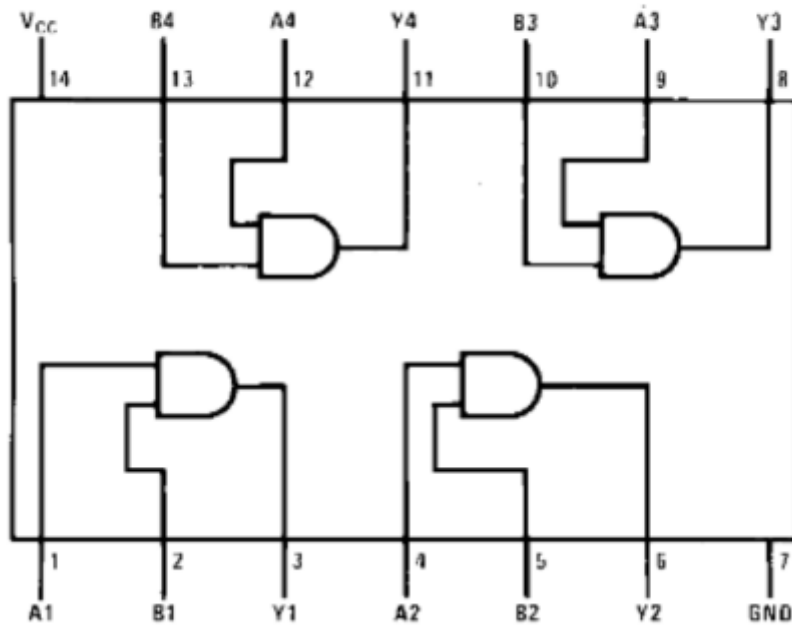
H = HIGH Logic Level

L = LOW Logic Level

From the IC truth table we can identify the boolean function about the gates in that particular IC. for example the IC 7408 consist of 2-input AND gates and the output will be H (High) only when both the input is H (High) otherwise the output will be L (Low) when at least one of the input is L (Low), the truth table of an IC corresponds to the logic function of the gates.

Connection Diagram

Connection Diagram



Connection diagram berguna untuk mengetahui fungsi dari suatu pin, berdasarkan contoh, terlihat bahwa pin 14 dan pin 7 berfungsi sebagai vcc dan ground. The connection diagram is used to identify the function of a particular pin. From the picture above we can tell that pins 14 and 7 are used for VCC and ground, respectively.