

Module 1 :

Introduction to

Digital Circuit

Learning Objectives :

1. Understand how to read a datasheet
2. Understand how an IC works
3. Understand how a breadboard works

- [Theory](#)

Theory

Introduction to Digital Circuit : Theory

Introduction

Before we make a digital system circuit, we have to know more about the **components** that will be used to make them first.

1. Power Supply

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Power supply is an electrical component that is used to **supply electrical power for other components**. The power supply that we mostly use in this lab are **batteries** and **Arduino Uno**. On a battery, there are two poles:

- **Positive pole (VCC)**
- **Negative pole (GND - Ground)**

These poles will then be connected to the components accordingly.

2. Cable

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Cable (or jumper cable) is an electrical component mostly used to **connect other** components. A cable allows electrical current to flow from one component to another. We'll use cables to connect each component until they become a singular circuit.

3. Breadboard

Breadboard (or "Protoboard") is a component used to **attach electrical components** such as jumpers, transistors, resistors, ICs, etc. into **one place**. 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 digital circuits.

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A breadboard consists of **many holes**, and each hole is connected in a specific way to a **metal plate**. Not all holes in the breadboard are connected to each other.

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There are two kinds of connections in a breadboard: **vertical** and **horizontal**.

- The **vertical connection** is placed in the top and bottom parts of the breadboard.
- The **horizontal connection** is placed in the middle part.

If you look at the diagram, holes connected by the **same colored line** share the same connection. When one of the holes in that color is connected to an electric current, the other holes in the same color lines will receive the same amount of current.

4. Integrated Circuit (IC)

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Integrated Circuits (IC) are various electrical components consisting of hundreds or even thousands of transistors, diodes, and resistors integrated to form a digital circuit with a specific function.

Every IC has multiple pins, each serving a distinct function. The function of each pin can be found in the **datasheet** provided by the manufacturer.

How to Read a Datasheet

1. Code

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From the picture below, we know that the IC code is **74LS08**. To determine the main function of the IC, we refer to the number in the code.

For example, in the **7408** IC, the number indicates that it is a **2-Input AND Gate IC**.

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Another example is the **74HC08** IC. Despite having a different prefix than **74LS08**, both serve the same function as **2-Input AND Gate ICs**.

A similar case is **74LS11**, which functions as a **3-Input AND Gate IC**.

2. Main Function

The main function of an IC can be identified from the title of the datasheet.

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Example:

- **"2-Input AND Gates"** → Each gate in the IC consists of only two inputs.
- **"Quad"** → The IC contains four gates.

3. Truth Table

From the IC's truth table, we can determine the Boolean function of the gates in that IC.

For example, in the **7408 IC (2-Input AND Gate)**:

- The **output is HIGH** only when both inputs are **HIGH**.
- If at least one input is **LOW**, the output is **LOW**.

Truth Table Example:

Input A	Input B	Output (AND)
L	L	L
L	H	L
H	L	L
H	H	H

4. Connection Diagram

The **connection diagram** helps in identifying the function of each pin.

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From the diagram, we see that:

- **Pin 14** is used for **VCC** (power).
- **Pin 7** is used for **GND** (ground).

How to Identify the Correct IC Pin Orientation

To correctly install an IC, we identify the correct pin orientation using:

1. **Notch**

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Ex: The pin on the top left is VCC, and bottom right is GND. Identifying which is the **true** orientation is crucial to determine the IC's pinout.

2. Printed dot

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3. Printed text

While the printed text can help, it may fade over time. The most reliable way is by identifying the **notch** and **dot** positions.

Attachment

Datasheets:

- IC 74LS08: [Datasheet Link](#)
- IC 74HC08: [Datasheet Link](#)
- IC 74LS11: [Datasheet Link](#)

Online Tool:

- Tinkercad: [Visit Tinkercad](#)