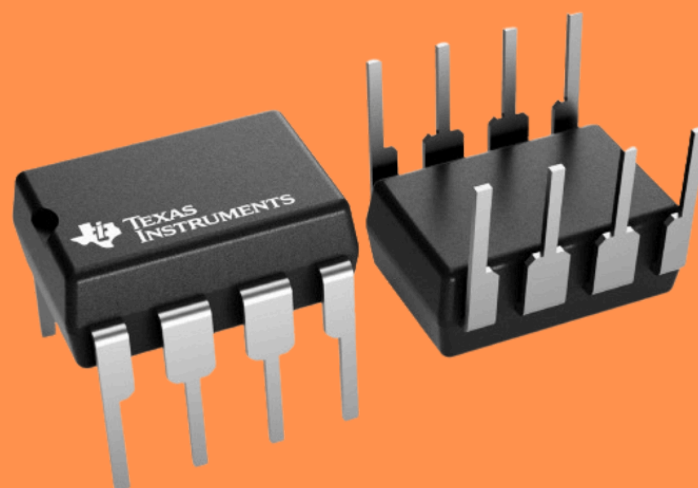
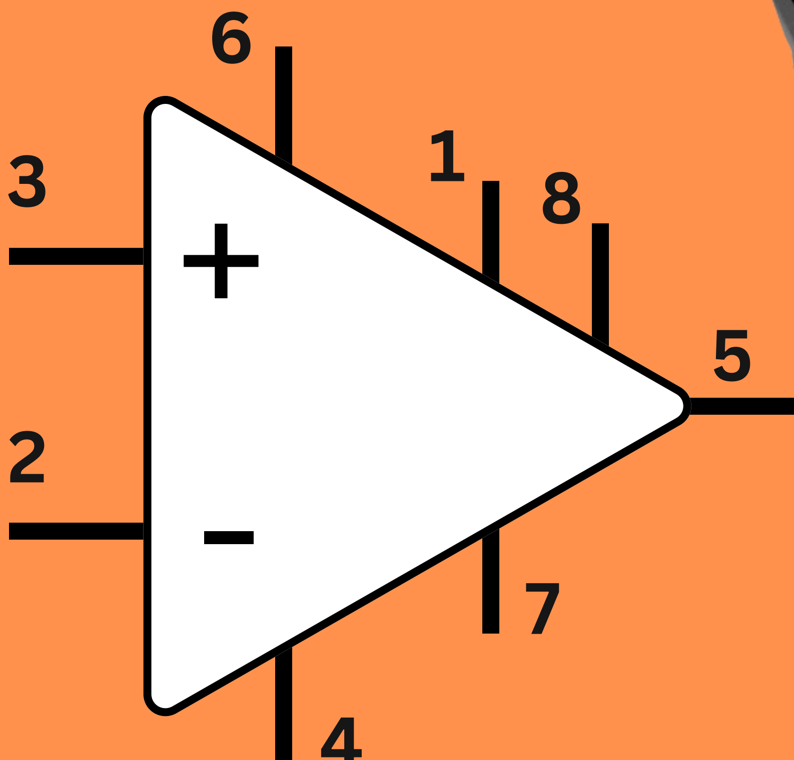
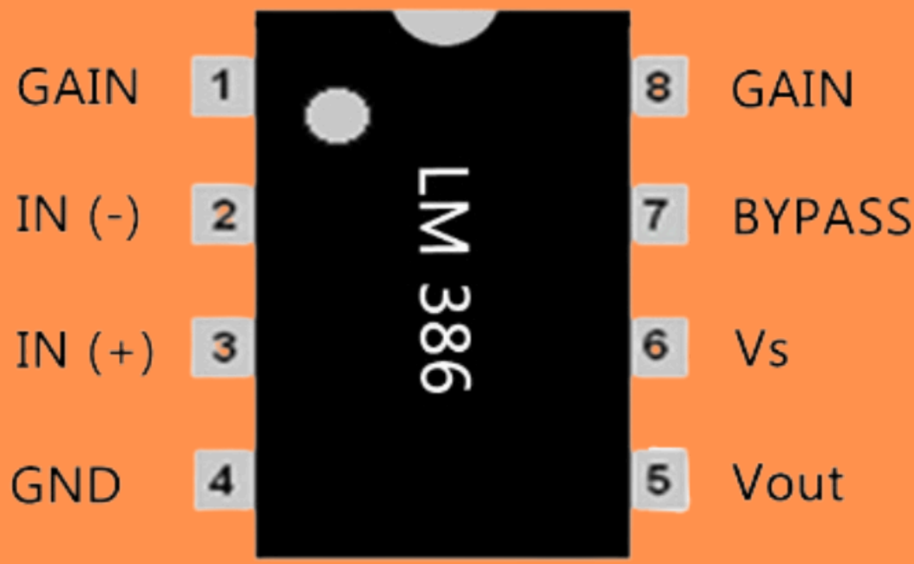
# AUDIO OP-AMP




IEEE
UNIVERSITY OF HOUSTON

# PINOUT DIAGRAM




**Pin 1 (GAIN):** With pin 8, it sets the amplifier voltage gain.

**Pin 2:** Inverting input (-).

**Pin 3:** Non-inverting input (+). Connected to an audio signal input.

**Pin 4:** Connected to ground (GND).

**Pin 8 (GAIN):** With pin 1, it sets the amplifier voltage gain.

**Pin 7 (BYPASS):** For noise reduction and stability. Connected to a capacitor.

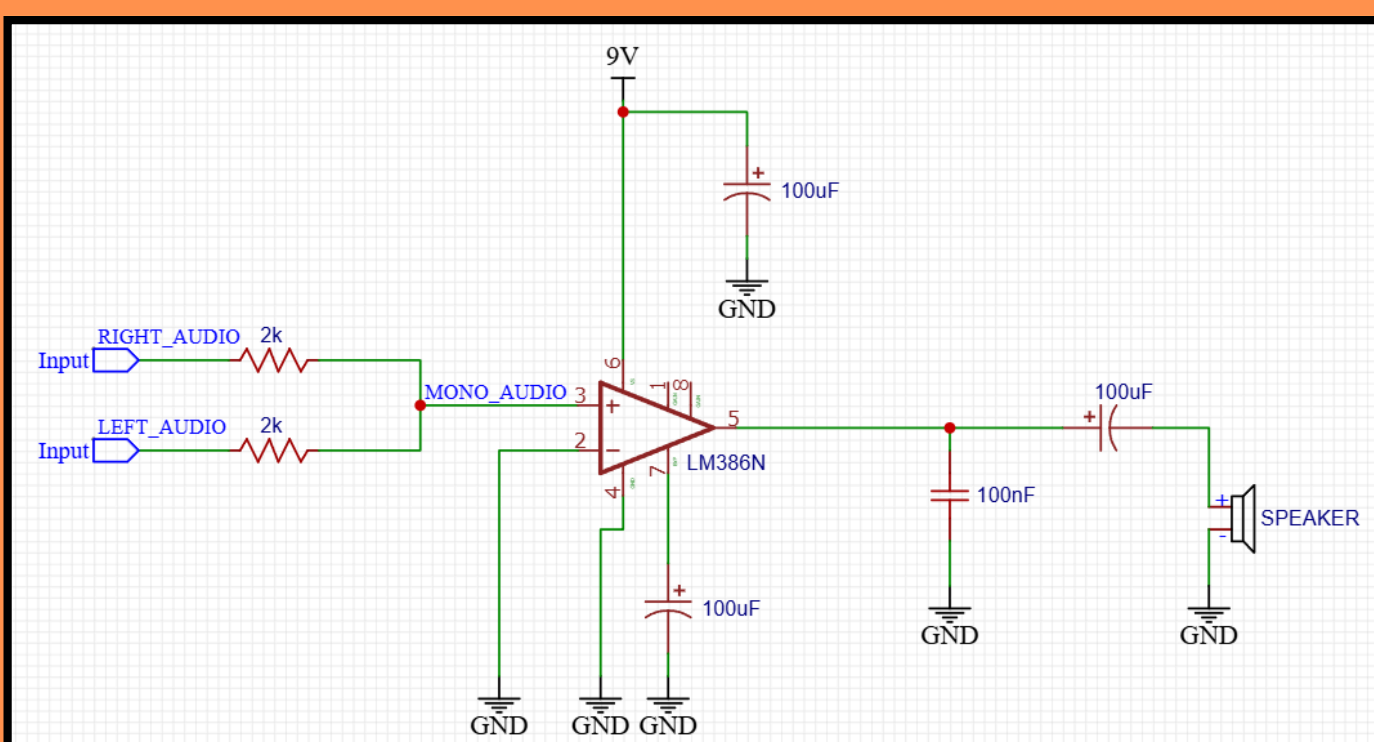
**Pin 6 (Vs):** To power supply.

**Pin 5 (Vout):** Output.

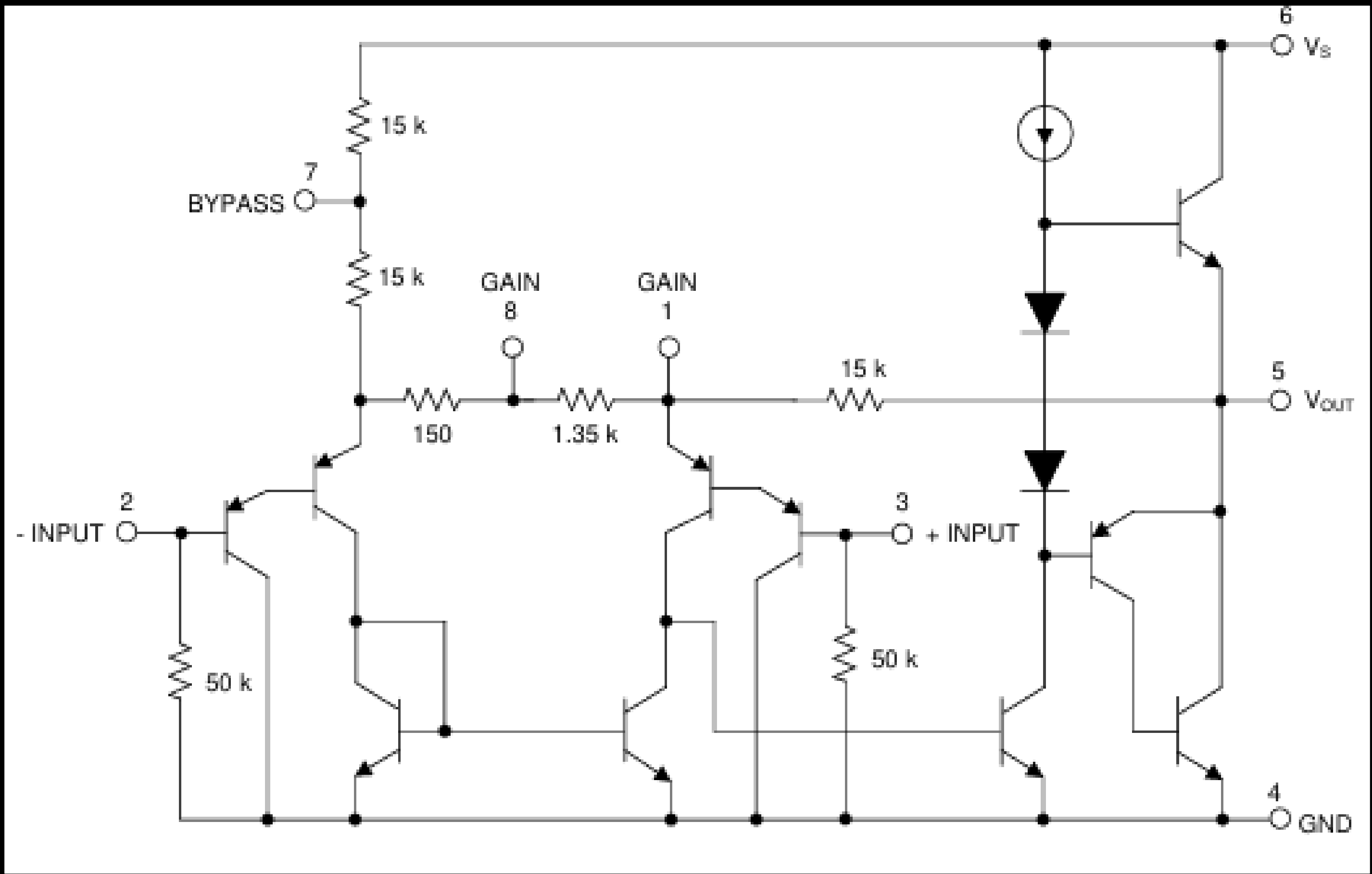
# MATERIALS

- 3 [100uF] polarized capacitors
- 1 [100nF] capacitor
- 1 mini speaker
- 1 Op Amp (LM386N)
- 2 [2kΩ] resistors
- 9V battery
- 3.5 mm audio plug

# SCHEMATIC



# INSIDE THE CHIP



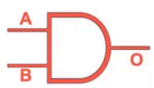
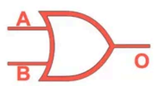
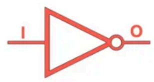
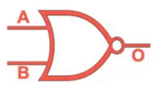
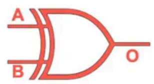
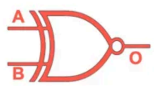
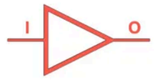

- **Input Stage:** Differential amplifier for small-signal input.
- **Gain Stage:** Provides default gain of 20, adjustable via pins 1 & 8
- **Output Stage:** Class AB push-pull amplifier.
- **Bias Network:** Sets internal DC reference (≈½ Vcc).
- **Feedback Network:** Provides stability and gain control.
- **Power Output:** Up to ~700 mW into 8 Ω at 9 V.

# LOGIC GATES

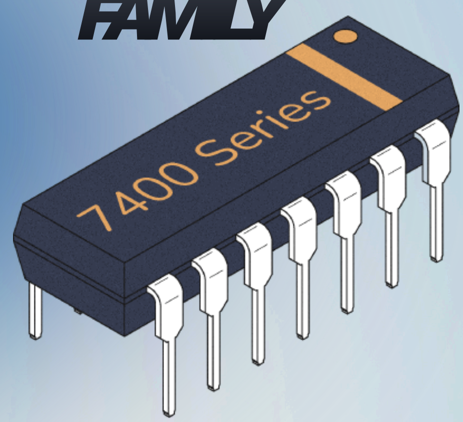
## WHAT ARE LOGIC GATES

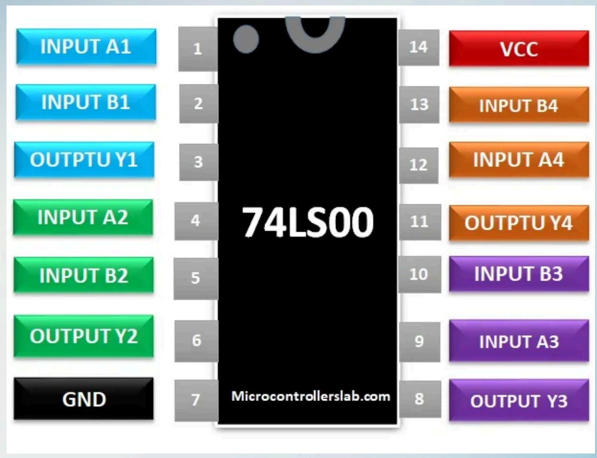
- Logic gates are fundamental components of all digital circuits.
- They control how electronic devices make logical decisions using binary signals.
- Each gate follows a rule from Boolean Algebra, using logic levels:
- Logic “1” = HIGH voltage (usually +5V)
- Logic “0” = LOW voltage (0V)
- These gates are built inside integrated circuits (ICs) using transistors.

## MAIN TYPE OF LOGIC GATES

| Gate | Symbol | Operator | Truth Table |
|---|---|---|---|
| AND |  | $O = A \cdot B$ | Input A, Input B, Output<br>0 0 0<br>0 1 0<br>1 0 0<br>1 1 1 |
| OR |  | $O = A + B$ | Input A, Input B, Output<br>0 0 0<br>0 1 1<br>1 0 1<br>1 1 1 |
| NOT |  | $O = \overline{I}$ | Input, Output<br>0 1<br>1 0 |
| NAND |  | $O = \overline{A \cdot B}$ | Input A, Input B, Output<br>0 0 1<br>0 1 1<br>1 0 1<br>1 1 0 |
| NOR |  | $O = \overline{A + B}$ | Input A, Input B, Output<br>0 0 1<br>0 1 0<br>1 0 0<br>1 1 0 |
| XOR |  | $O = A \oplus B$ | Input A, Input B, Output<br>0 0 0<br>0 1 1<br>1 0 1<br>1 1 0 |
| XNOR |  | $O = \overline{A \oplus B}$ | Input A, Input B, Output<br>0 0 1<br>0 1 0<br>1 0 0<br>1 1 1 |
| Buffer |  | $I = O$ | Input, Output<br>0 0<br>1 1 |

## THE 74 - SERIES LOGIC FAMILY



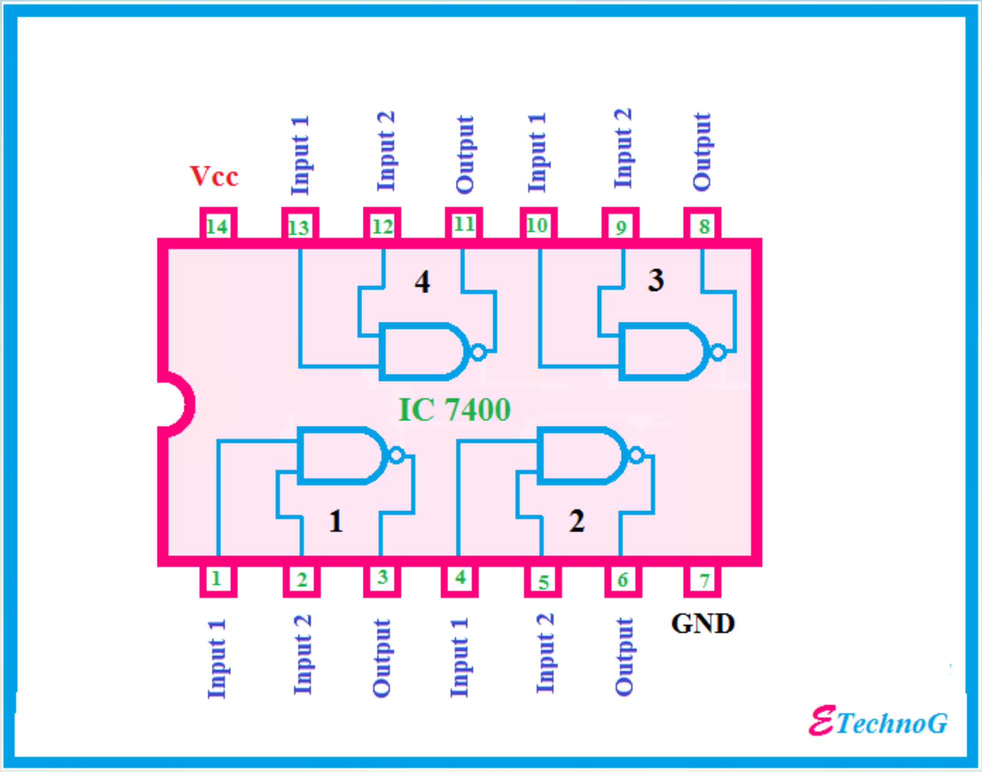

## UNIVERSAL GATES

**NAND Gate** → can make AND, OR, NOR, and NOT gates.

**NOR Gate** → can also form any other gate.

That’s why most digital circuits from calculators to computers can be built using only NAND gates.

# PINOUT
# DIAGRAM IC 74000

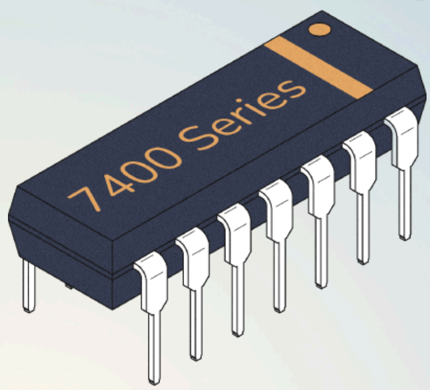


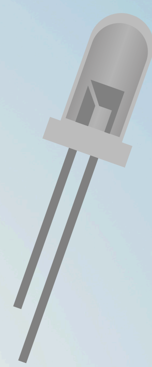

**Pin 1**: Input A for Gate 1. The button connects to +5V. When pressed, it gives logic HIGH.
**Pin 2**: Input B for Gate 1.
**Pin 3**: Output of Gate 1. Drives the LED
**Pin 4:** Keeps gate stable, prevents floating input.
**Pin 5:** Same as Pin 4
**Pin 6:** Y-output ($2^{nd}$ gate)
**Pin 7:** the ground terminal
Pin 8: Y-output ($3^{rd}$ gate)
Pin 9: B-input ($3^{rd}$ gate)
Pin 10: A-input ($3^{rd}$ gate)
Pin 11: Y-output ($4^{th}$ gate)
Pin 12: B-input ($4^{th}$ gate)
Pin 13: A-input ($4^{th}$ gate)
Pin 14: VCC (provide the positive supply voltage)

# NAND
# GATE

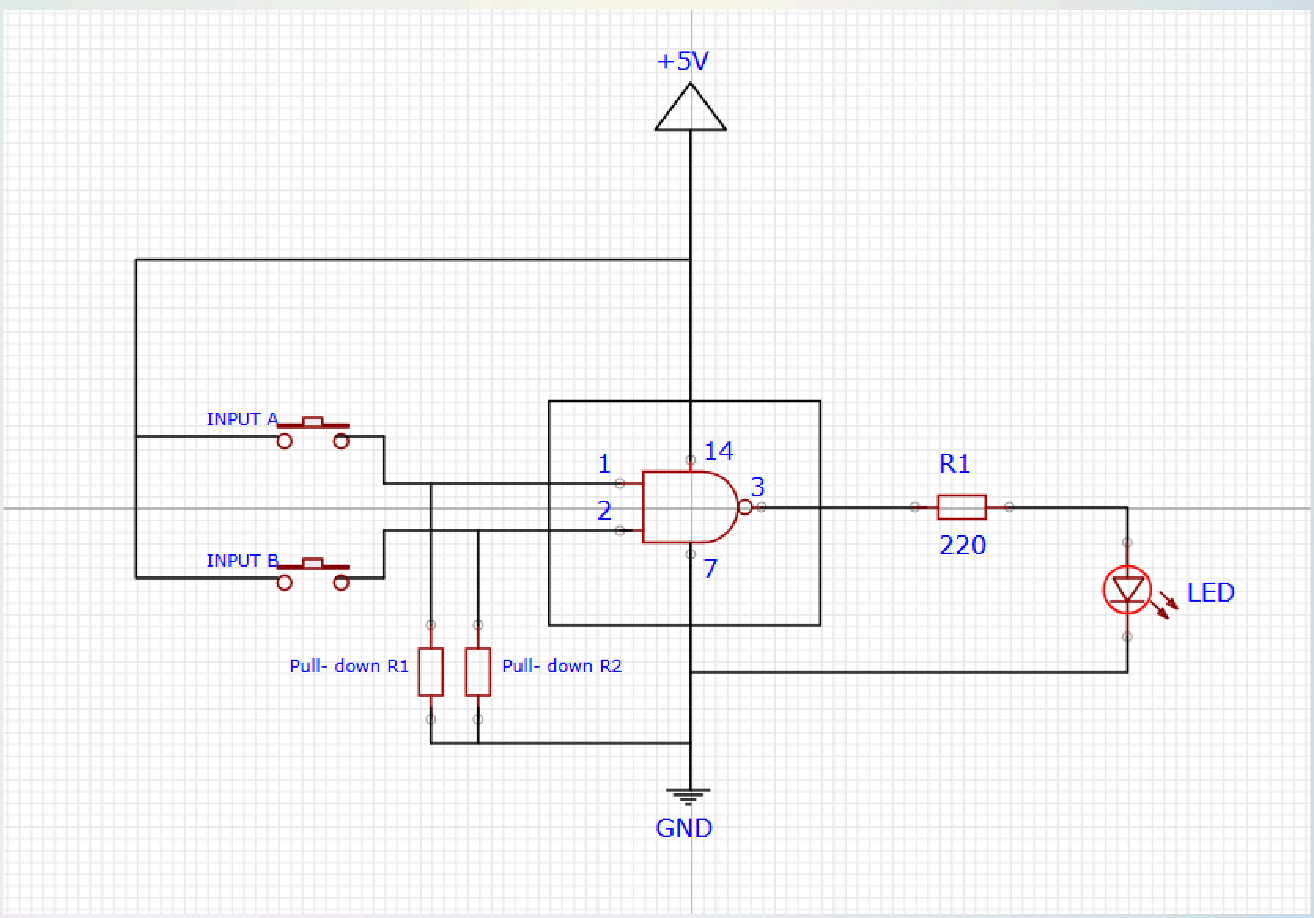
## MATERIALS

- 2 buttons
- 1 LED light
- 74LS00 / HCOO
- 1 [220 Ω] resistors
- 2 Pull-down resistors
- 5V battery

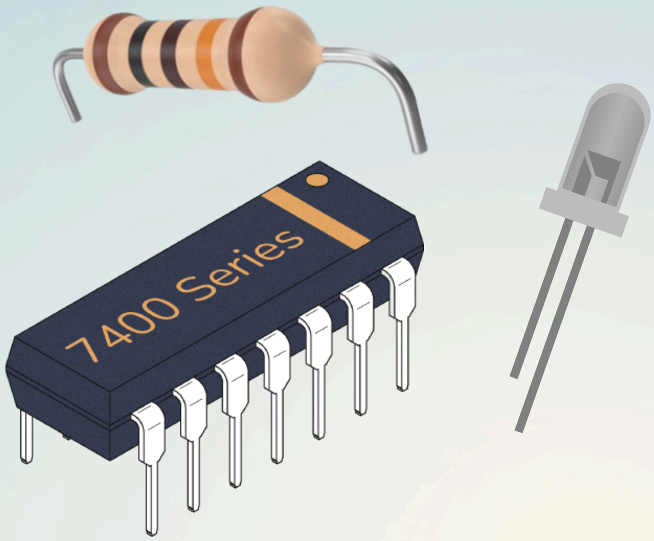


## SIMPLE



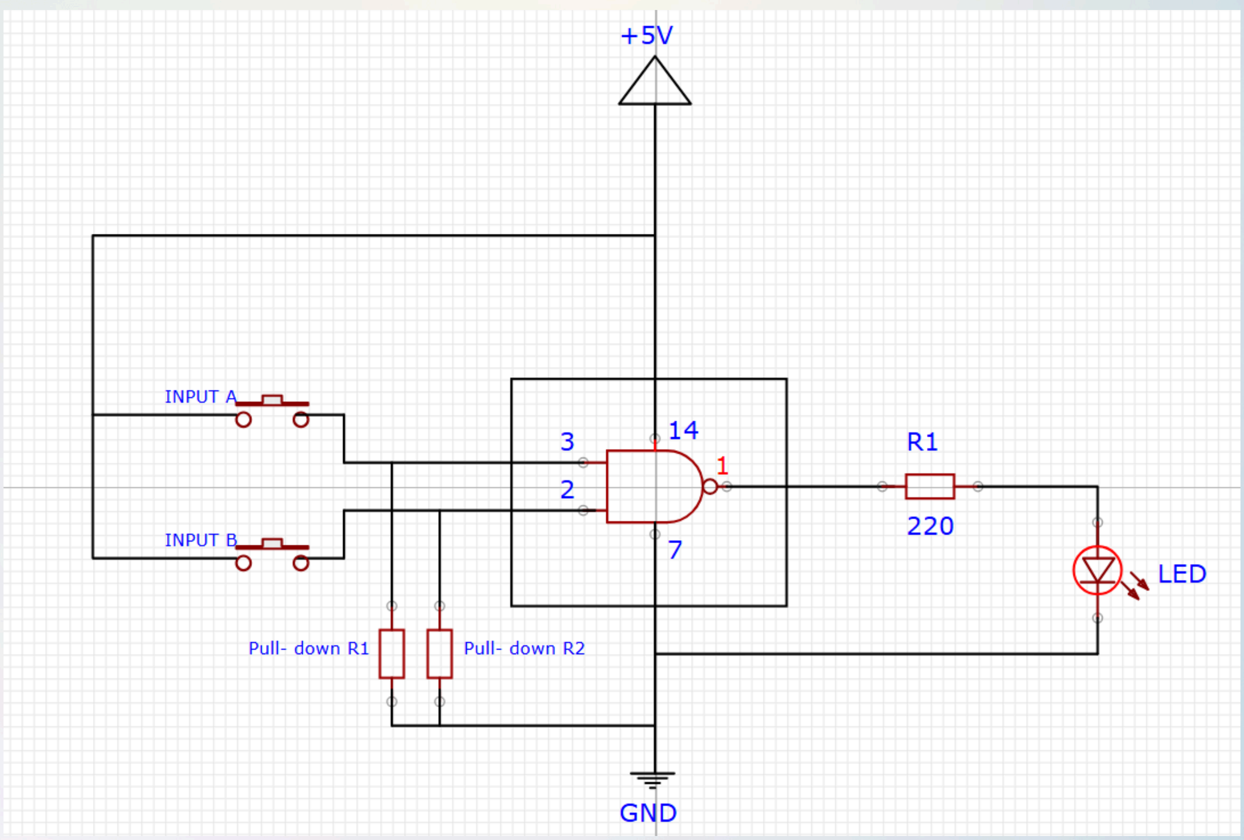
# NOR
# GATE




## MATERIALS

- 2 buttons
- 1 LED light
- 74LS00 / HCOO
- 1 [220 Ω] resistors
- 2 Pull-down resistors
- 5V battery

## SIMPLE



With Transistors!!

# Build Your Own Logic Gates!

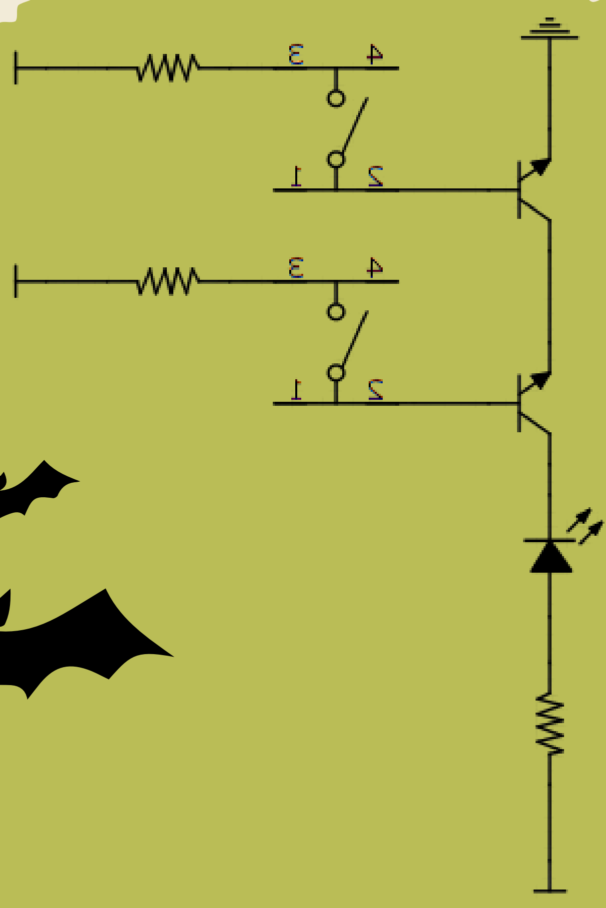

**Explore the magic of electronics and logic circuits**

# AND Gate

## Materials:

- 3 1K resistors
- 2 pushbuttons
- 1 LED
- 2 NPN transistors

## Schemati



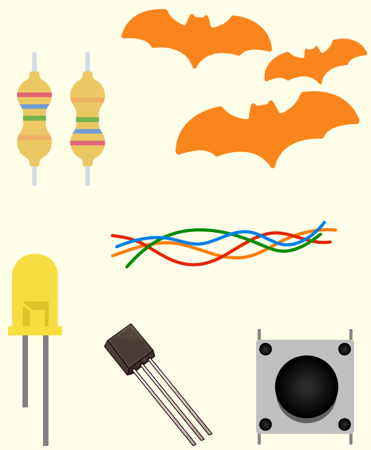
## Truth Table

| A | B | Q |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

# NOT Gate

## Materials:

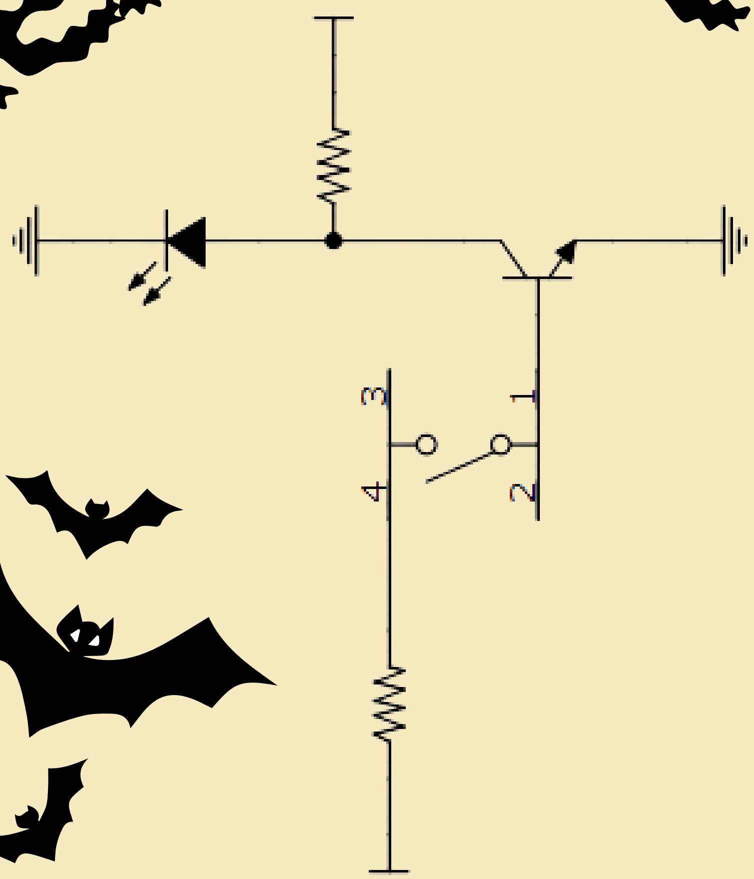
- 2 1K resistors
- 1 pushbutton
- 1 LED
- 1 NPN transistor



## Truth Table

| Input | Output |
|---|---|
| 1 | 0 |
| 0 | 1 |

## Schematic



# OR Gate

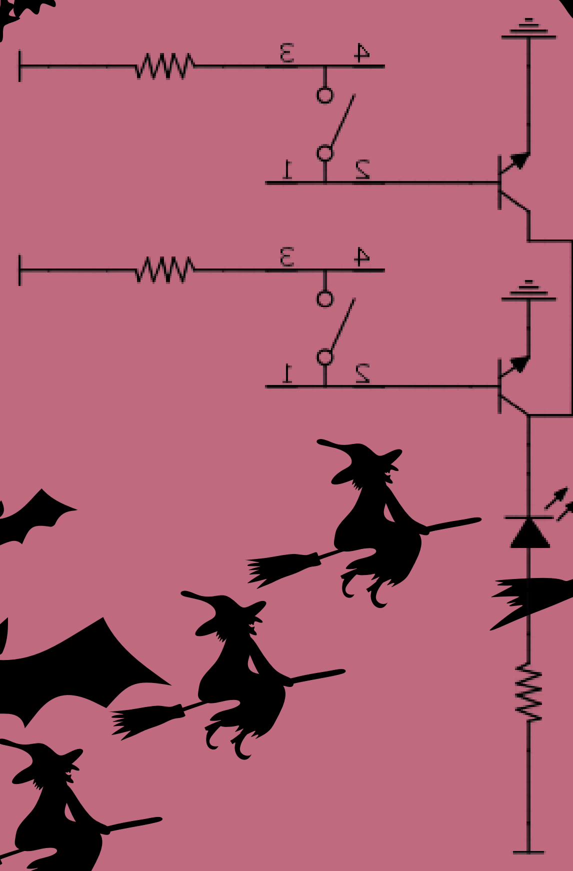
## Materials:

- 2 1K resistors
- 1 pushbutton
- 1 LED
- 1 NPN transistor

## Truth Table

| | | |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

## Schematic



# LED PAINTBOX

## USING POTENTIOMETERS!!!

## Materials:

- 3 330 [KOHM] RESISTORS
- 3 1 [KOHM] POTENTIOMETERS
- 1 RGB LED
- JUMPER WIRES
- BREADBOARD
- 1 9 [V] BATTERY

## Summary:

This circuit is an RGB LED color mixer that uses three potentiometers to control the brightness of the red, green, and blue channels individually. Each potentiometer adjusts the voltage sent to one color pin of the LED, allowing you to blend the colors in different proportions to create various shades. The resistors protect the LED from excessive current, while the 9V battery provides power to the circuit. By turning the knobs, you can smoothly change the LED's color output through analog control.