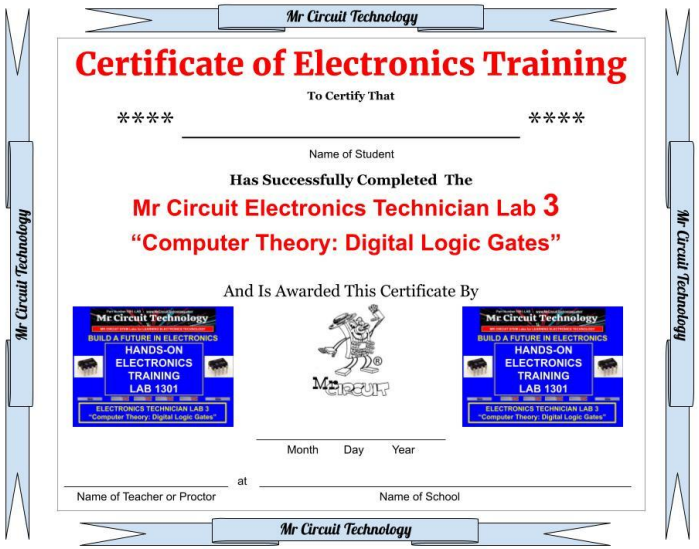
COVER

# This is the *FIFTH* lesson in the

# MR CIRCUIT LAB 3.




## COMPLETE THIS LAB 3 AND EARN A CERTIFICATE OF ELECTRONICS TRAINING

**LAB 3: Computer Theory: Digital Logic Gates**

05 00 COVER 1301-SL5



## Basic Electronics

# LAB 3

## Digital Logic Gates for future Engineers and Techs

# Lesson 5

# The ‘OR’ Logic Gate

INPUTS  OUTPUT

**There are 3 pages. Start with Page 1 at the center of this booklet.**

Booklet Number 1301-SL5



MR CIRCUIT ELECTRONICS TRAINING LAB

Mr Circuit Technology

For more info:

www.MrCircuitTechnology.com

MrCircuit23@gmail.com

# Introduction to Digital Logic Gates "The 'OR' Logic Gate"

The **'OR' Logic Gate** has two inputs and there are 4 possible combinations on these inputs as shown in the Truth Table below. If either input is True, the output is True. Both inputs have to be False for the output to be False.

Here is the symbol for a 'OR' Logic Gate.



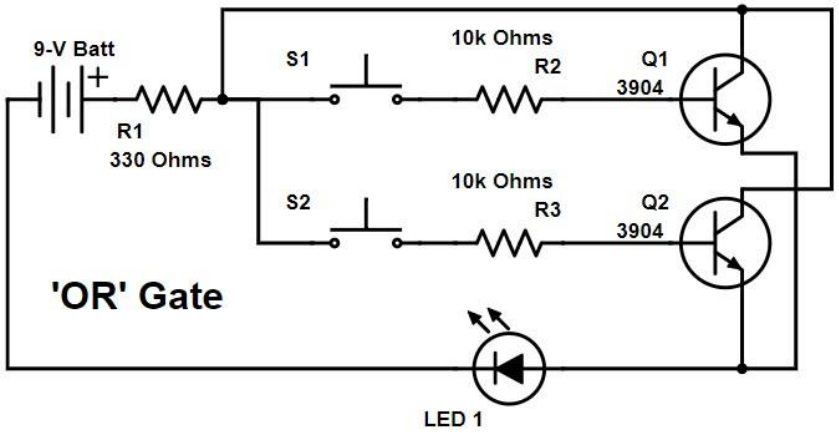

Here is the Truth Table for an 'OR' Logic Gate. You will notice that if A = 1 or B = 1, that the output Q is a 1. Only when both inputs A and B are 0 is the output Q a 0.

**Truth Table for the 'OR' Gate**

| Input A | Input B | Output Q |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

**LAB 3: Computer Theory: Digital Logic Gates**

Here is a schematic of an electronic circuit that performs the function of a 'OR' Logic Gate.




**Explanation of the circuit:** This circuit has two transistors. If you forward-bias either one or both of them, the LED will light up indicating a HI on the output.

There are two Normally-Open pushbutton switches in this circuit. Switch S1 controls the voltages on Transistor Q1 and Switch S2 controls the voltages on Transistor Q2. If you press S1, it causes Q1 to be forward-biased which allows current to flow from the LED through the transistor and the LED will light up. If you press S2, it will cause Q2 to be forward-biased and the LED will light up. If you press both switches at the same time, it forward-biases both transistors and the LED will also light up.

So, as you can see, this circuit acts like an 'OR' Logic Gate, that is, if either or both inputs are True the output will be True. Switch S1 gives a True to Transistor Q1 and Switch S2 gives a True to Transistor Q2. The circuit is wired such that there will be a HI on the output when your press either switch or both switches at the same time.

Now, use the QR Code to watch video Lesson 5. Then, using pages 2 and 3 in this booklet, build a **'OR' Logic Gate** circuit.

# Step-by-Step Assembly Guide for "The 'OR' Logic Gate"

**Step 1:** Follow these steps carefully to build the **'OR'** Logic Gate.

.

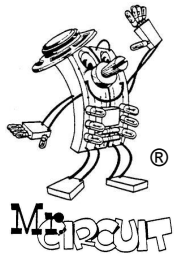
**Step 2:** Find the Experiment Parts Bags for the Mr Circuit Lab 3

**Step 3:** Take out the following parts needed to build the **'OR'** Logic Gate:

- one Solderless Circuit Board
- one 9-Volt Battery Snap
- one LED (Light Emitting Diode)
- one 330 Ohm resistor (Brown, Black, Red, Gold)
- two 10,000 (10k) Ohm resistors (Brown, Black, Orange, Gold)
- seven Jumper Wires
- two NPN Transistors (3904)
- two Normally-Open Pushbutton Switches

**Step 4:** Now, using the Pix of the Assembled Circuit on Page 3, install all the parts on the Solderless Circuit Board in this order.

__ **Install** the NPN transistor Emitter in 7b, Base in 6b, Collector in 5b
__ **Install** the NPN transistor Emitter in 7g, Base in 6g, Collector in 5g
__ **Install** the LED, Cathode in 8h, Anode in 7h
__ **Install** a 330 Ohm resistor in 25a to 17a
__ **Install** a 10,000 Ohm resistor in 11j to 6j
__ **Install** a 10,000 Ohm resistor in 11e to 6e
__ **Install** a Jumper Wire in 27j to 8j and another in 27f to 8g
__ **Install** a Jumper Wire in 17e to 13j and another in 17d to 13e
__ **Install** a Jumper Wire in 7f to 7c
__ **Install** a Jumper Wire in 5f to 5c
__ **Install** a Jumper Wire in 17b to 5a
__ **Install** the Battery Snap, Red in 25b, Black in 27h
__ **Install** the two Normally-Open Pushbutton switches with 4 legs. Install the legs as shown here.





**Switch S1**


**Switch S2**

**Step 5:** Lightly touch the battery to the Battery Snap (Note: do not connect it, just touch it lightly.) The LEDs should not light up. If it does, then please check your wiring carefully and try again.

**Step 6:** With the battery connected, press Switch S1. Did the LED light up? ____

**Step 7:** Press Switch S2, did the LED light up? ____

**Step 8:** Now, press both switches at the same time forward-biasing both transistors. Did the LED light up?_____ .

**Step 9:** Conclusion: You should have observed that this circuit works like an **'OR' Logic Gate.**

When Switch S1 puts a HI on the Base of Q1, the LED lights up indicating a HI on the output. And, when Switch 2 puts a HI on the Base of Q2, the LED lights up. And, when you press both switches at the same time, the transistors are both forward-biased and the LED lights up.

You have now learned how an 'OR' Logic Gate works and how to build one using electronic components. These are the same type of components used in today's digital circuits.

**Step 10:** Now, disassemble the circuit and put all the parts back into the plastic bag and go to the next lesson in this lab.

**LAB 3: Computer Theory: Digital Logic Gates**



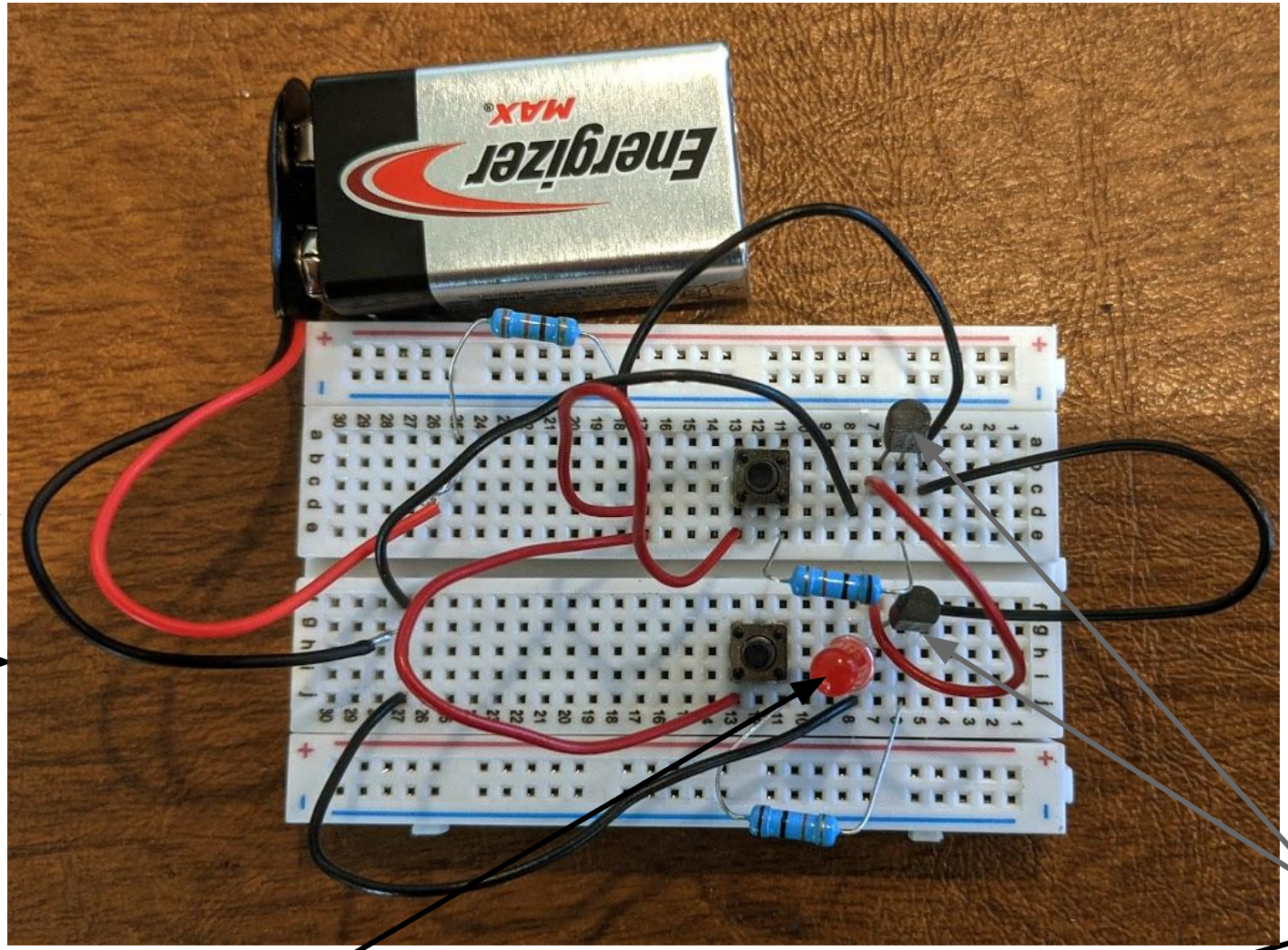

PAGE 2

# Assembly Pix for Lesson 5 “The ‘OR’ Logic Gate”

PAGE 3

S1

S2




PAGE 3

Q1

Q2

Cathode

Lesson 3 - The ‘OR’ Gate

Flat side

E B C

LAB 3: Computer Theory:
Digital Logic Gates