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**LABORATORY REPORT**  
**DIGITAL CIRCUIT DESIGN**  
**INTRODUCTION TO DIGITAL LOGIC**

**INTRODUCTORY SUMMARY**

The aims of this Lab Session are:

- (a) to build a *Test Bench* that you will use to build and test all your digital circuits *and*,
- (b) to reinforce the ideas on the operation of the basic set of digital logic gates (i.e., AND, NAND, OR, NOR and NOT) by testing a series of 5 integrated circuits and completing their truth tables.

We will then combine a small number of gates to produce other simple functions. In later experiments, we will use these gates as building blocks to construct more complex functions (e.g., *adders* and *multipliers*).

**LAB MATERIALS**

All the experiments are performed on a Test Bench, which is a general-purpose logic board or “breadboard” with a fixed hardware configuration, into which integrated circuits can be inserted. Besides breadboard we also need a DIL switch, a LED Bar Graph Array, two 2 SIL Communed Resistors. The most important equipments in this lab are 8-Channel Darlington Driver ICs. The last material we need are wires.

**LAB PROCEDURE**

Once we start doing this lab, we first try to test the logic gates whether they match their truth table. After getting their functions we have to make great use of their features to construct more complex functions like adders. We separated the whole lab into two parts.

**Part 1**

We only need to test one gate on each IC. Connect the input(s) to the DIL Switch, via the SIL Communed Resistor and the output to an LED in the LED Bar Graph Array, via the 8-Channel Darlington Driver IC. Set the switches first to ‘0’ and look at the output LED. ‘ON’ indicates logic ‘1’, and ‘OFF’ indicates logic ‘0’. Note the result in the appropriate place in the table.

Continue with the remaining switch combinations, then test the next IC. If any of the results are not as we expected, double check that the connections are correct. Then go over our

experimental procedure again. If it looks as though the IC may be faulty, ask for another one and repeat the experiment.

## **Part 2**

The Exclusive OR function is used less frequently than the other standard forms that we have used so far, and so is not available directly on an IC. However, it can be implemented in a number of different ways; probably the simplest way is using all four gates on a 7400 IC.

Used known logic gates to build a half adder and completed its truth table.

## **8-Channel Darlington Driver IC Extraction Technique**

- a. Draw the lab diagram
- b. Select different ICs that we need
- c. Determine which port should connect to the VCC and ground
- d. Connect the inputs and outputs by wires as diagram

## **PROBLEM ENCOUNTERED**

The entire lab procedure as planned. The only problem is that we put the 8-Channel Darlington Driver ICs and the LED in the opposite turn. So though our circuit is right, we can not see the experiment result (LED always dark). Luckily, we finally find out the mistake and make it right. Then finish the experiment successfully.

## **CONCLUSION**

Through this lab we are more familiar with the functions of different logic gates. Meanwhile, the truth table of them we can easily remember. After testing by ourselves, we will build our own circuit to realize some complex function. However, in order to get deeper in digital circuit, we still have a long way to go.

Next time we may try to use computer to realize a virtual circuit.

Sincerely,



Du Pan  
A Sophomore