Synopsis - Week 9 Integrated Project: Probing Fixed IC Gates with Oscilloscope, DC Power Supply, Breadboard, and Digital Voltmeter

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1 Reading the Specification Sheet of IC Gates

Today we will be working with the Texas Instruments SN74HC00N component. This is a 14-pin DIP package containing 4 NAND gates, each with 2 inputs and 1 output. The specification sheet is posted to the course Moodle page, under Week 7. Note the specification includes the functional block diagram (Fig. 1, left). Note that there are 4 gates, requiring 8 inputs and 4 outputs. There are two additional pins, $V_{\rm CC}$ (DC power), and GND (ground). Pairs of inputs are labelled 1A, 1B, 2A, 2B, ..., and outputs are labelled 1Y, 2Y, ...

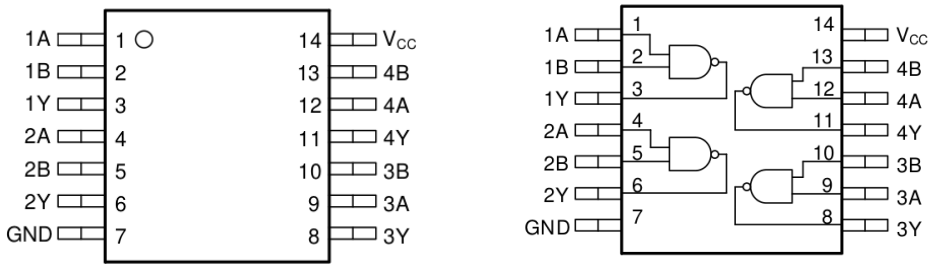

Figure 1: (Left) The pinout for the SN74HC00N 14-pin DIP. Note the locations of $V_{\rm CC}$ and GND relative to the notch at the top left. (Right) The functional block diagram of the SN74HC00N shows how the 4 NAND gates are internally connected. The gates are labelled A, B, C, and D, with Y indicating outputs.

Using the Table of Contents and tables within the specification sheet, answer the following questions.

- What is the maximum range for the supply voltage $V_{\rm CC}$?
- If the supply voltage is 3.3V to 5V, what is the minimum input HIGH voltage, $V_{\rm IH}$?
- If the supply voltage is 3.3V to 5V, what is the maximum input LOW voltage, $V_{\rm IL}$?
- What is the maximum propagation delay, $t_{\rm pd}$, for the commerical version of this component? What does this imply about the maximum clocking frequency for these gates?

2 Breadboard Setup, Connecting the IC Gates

Make sure that your lap table is powered, and that the DC power supply is connected. Switch on the power supply, and use the digital voltmeter to check that the voltage between the red and black (GND) terminals is 3.3 V. Use the red and black banana-plug cables to route power down to your breadboard. Use the red breadboard post for $V_{\rm CC}$, and the black post for GND. Use the DVM to check that the voltage between the posts is still 3.3V. Now turn off the DC power supply. Unscrew the red post cap until you find a hole through the post. Do the same for the black post. Slide jumper wires into these holes, and then screw the post down to hold the jumpers in place. Orient the posts away from you on the table. Note in Fig. 1 (left) the pinout of the DIP package for the IC gates contains a notch near pin 1. Straddle the counter across the center divide of the breadboard such that pin 1 is oriented away from you. The IC gates should be within range of the jumpers so that the hot jumper can bring $V_{\rm CC}$ to pin 14, and the GND jumper can bring GND to pin 7.

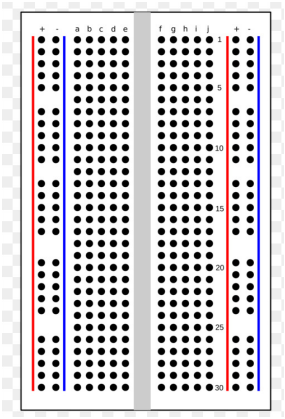

Figure 2: (Left) The basic breadboard layout. The rows of five pins are connected, but the connection does not persist across the center divide. Outer columns of five pins are also connected. (Right) Place the IC counter across the divide, and connect V_{CC} to pin 1 and GND to pin 8.